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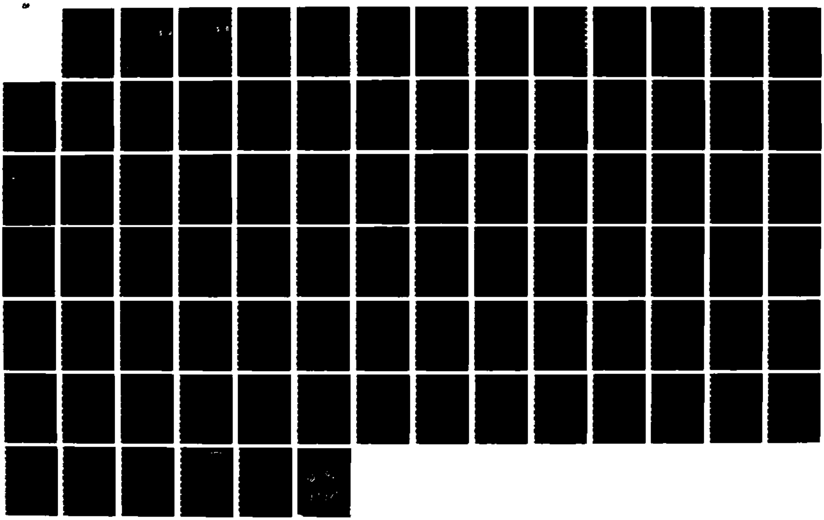

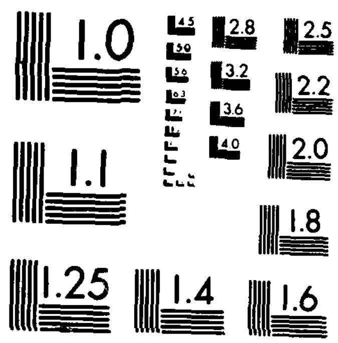

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DYNA-METRIC INVENTORY MODEL
DURING INITIAL PROVISIONING

THESIS

Robert R. Yauch, B.S.
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AN ASSESSMENT OF THE DYNA-METRIC INVENTORY MODEL DURING INITIAL PROVISIONING

THESIS

Presented to the Faculty of the School of Systems and Logistics

of the Air Force Institute of Technology

Air University

In Partial Fulfillment of the

Requirements for the Degree of

Master of Science in Logistics Management

Robert R. Yauch, B.S.

Captain, USAF

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Robert R. Yauch

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Abstract

A goal of initial provisioning is to provide the highest level of readiness for a fixed level of investment. MOD-METRIC and AFLCR 57-27, the traditional initial provisioning methods, determine which spare parts are needed and in what quantity without considering aircraft readiness. On the other hand, Dyna-METRIC, an availability model, quantifies the number of spares needed and finds the optimal mix for a dynamic initial provisioning environment.

This ~~research~~ is a comparison of the requirements computation (stock level) recommended by each method and a comparison of the aircraft availability that resulted from those stock levels. The data consists of 41 fuel system Line Replaceable Units modeled during the initial provisioning of the F-15 aircraft in FY 73 and FY 74.

Results indicate that the Dyna-METRIC model performed equal to or better than the traditional methods for computing initial spare requirements given the same investment constraint. Further, the research suggests that the Dyna-METRIC model would recommend a smaller inventory of spare parts than the MOD-METRIC model while maintaining an equal level of performance.

AN ASSESSMENT OF THE

DYNA-METRIC INVENTORY MODEL

DURING INITIAL PROVISIONING

I. Introduction

Background

AFM 1-1, Basic Aerospace Doctrine of the United States Air Force, describes the proper use of aerospace forces in military action and provides broad guidelines for preparing and employing those forces. One of the guidelines outlined in Chapter Four of AFM 1-1 involves Equipping Aerospace Forces. Equipping Aerospace Forces is one of the major responsibilities that Congress has given the Department of the Air Force. To fulfill this responsibility "the Air Force must develop enduring aerospace systems and ones that possess an optimum mix of the fundamental characteristics of speed, range, and flexibility" (11:4-8).

Restricting any one of these characteristics will inhibit the capability of the weapon system to respond with force in a conflict. The ability of the Air Force to project these characteristics into a conflict establishes force readiness, the most fundamental requirement of our

defense posture. This force readiness cannot be maintained during a conflict without the required supply of spares and repair parts.

> The capacity to deter, or to fight and win, such a conflict hinges on the ability to project fighting forces where and when they are needed and to sustain them for as long as they are needed. Readiness and sustainability, therefore, are the backbone of today's national defense posture. (27:3)

To maintain readiness and sustainability, the initial provisioning process must address which spare parts are needed, and in what quantity. AFR 800-36, Provisioning of Spares and Repair Parts, establishes a number of Air Force provisioning objectives to reach this goal. One important objective is to "procure the range and depth of spares needed to support baseline readiness and availability objectives that were determined based on priority of the system and the logistics costs" (14:1).

Two methods are currently used to quantify the stockage posture needed to meet this baseline of support in initial provisioning. They include (15:1): 1) AFLCR 57-27, Initial Requirements Determination and, 2) the MOD-METRIC computer model. The AFLCR 57-27 computational process seeks to answer the range and depth decisions for spares and repair parts without taking into consideration system readiness or availability.

Similarly, the objective of MOD-METRIC is to minimize the total number of backorders for a set of components with respect to a given budget constraint. MOD-METRIC treats every backorder as if it would result in an aircraft that is not fully mission capable (16:1-2). The use of backorders as a criterion does not give any indication of the number of aircraft available to perform the mission. Therefore, a valid method is needed to relate initial provisioning to weapon system readiness and availability. This research effort will demonstrate the capabilities of Rand Corporation's Dyna-METRIC inventory model as a decision making tool for use when computing initial provisioning requirements.

Problem Statement

The validity of the Dyna-METRIC computer program in computing initial spares levels needs to be assessed. This assessment will be accomplished by comparing initial spare computations from AFLCR 57-27, MOD-METRIC, and Dyna-METRIC models using data acquired during the initial provisioning of the F-15 weapon system.

Purpose

The purpose of this research is to assess the potential benefits of Rand Corporation's Dyna-METRIC inventory model for computing initial spares levels. Currently, Air Force

policy for the provisioning of initial spares and repair parts requires that "all acquisition programs will use AFLCR 57-27 for requirements computations" (14:3). However, further guidance in AFLCR 57-4, Recoverable Consumption Item Requirements System (D041), prescribes procedural instructions in computing these recoverable end items and identifies an additional computational method. Specifically, these two methods are:

1. Manually, through the use of AFLC Form 614, Recoverable Items Requirements Computation Worksheet (Initial Replenishment), and

2. Mechanically, by means of an authorized math model (MOD-METRIC) (AFLCR 57-27) or comparable mechanical process. (15:1-1)

Requirements levels for spare and repair parts were derived from a combination of both methods during the initial provisioning process for the F-15 in FY 73 and FY 74 (24). But these methods of computation may not calculate the optimum quantity of necessary components with respect to a given budget constraint. Dyna-METRIC on the other hand, was primarily designed to measure reparable spares requirements during dynamic wartime conditions, where changes in aircraft usage put stress on the logistics support system (28:v). Therefore, Dyna-METRIC may provide a better decision making tool in determining the spare parts necessary to maintain a desired level of aircraft availability.

This research effort will follow-on Captain Michael G. Mills' Master of Science Thesis by addressing one of his recommendations. He states that "the validation and use of the [Dyna-METRIC] model for calculating initial spares requirements would benefit the Air Force and enhance an important portion of the acquisition process" (25:56). In addition, the procedures developed in this research will provide guidance in handling future comparison problems involving the implementation of AFLCR 57-27, MOD-METRIC and Dyna-METRIC models.

Research Objectives

The research objectives are twofold. First, a comparative technique will be used to analyze the absolute difference of stock levels produced by the three computation methods. The input to these methods include realistic initial provisioning scenario and planning data acquired from the FY 73 and FY 74 initial provisioning process for the F-15 weapon system.

Secondly, using the stock levels as input, these three methods will be evaluated on the basis of aircraft availability for the two year initial provisioning period. The similarities and differences of each method used in the initial provisioning process will be discussed.

Scope

This research will examine the initial provisioning requirements computations for AFLCR 57-27, MOD-METRIC, and Dyna-METRIC models. The data base will be taken from historical information available at McDonnell Aircraft Company. This data will be limited to the analysis of 41 spare parts that comprise the fuel system of the F-15 aircraft.

Further, this thesis will analyze only reparable (non-consumable) spare parts. It is estimated that these items account for some 95 percent of all money spent on supplies stocked in a typical base supply organization (3:5). However, these same spares compose only five percent of the total purchased items in the Air Force inventory. The key to an effective inventory policy, and a credible defense posture in times of a constrained budget, is to maximize the repair and reuse of these assets (5:3). While conclusions drawn may be applicable to all Department of Defense systems, the results will focus only on the initial provisioning of the F-15 weapon system.

II. Literature Review

Overview

To build a basic foundation of understanding this chapter will begin with a brief discussion of the initial provisioning process. The provisioning process determines the type and quantity of initial spares and support equipment required to support a new end item or weapon system. The methods used to quantify F-15 spare and repair parts are the focus of this research and therefore, they will be examined and explained. These methods include calculations from AFLCR 57-27, the MOD-METRIC computer program, and the Dyna-METRIC computer program.

Initial Provisioning Process

The Department of Defense defines provisioning as:

> The management process of determining and acquiring the range and quantity of support items necessary to operate and maintain an end item of material for an initial period of service. (7:2-1)

Provisioning, therefore, ensures the timely availability of initial stocks of spares and repair parts at using commands and maintenance organizations. These initial stocks sustain the programmed operation of end items until normal supply

procedures can take over (10:19-1). The three types of provisioning are: 1) initial provisioning, 2) follow-on provisioning, and 3) reprovisioning. Initial provisioning is the first-time provisioning for new end items or systems. Follow-on provisioning is the subsequent provisioning of the same end items procured from the same contractor, and reprovisioning is provisioning of the same end items procured from a different contractor (7:2-1).

The focus of this research is on the initial provisioning period. The spare parts involved are defined as:

> Reparable spares and repair parts needed to support and maintain newly fielded systems or subsystems during the initial phase of service, including pipeline quantities needed as initial stockage at all levels. (17:1)

Two ingredients are required to successfully implement the initial provisioning for these spare parts. They are the provisioning strategy and the formal provisioning process.

The provisioning strategy is composed of specific methods and techniques essential to the effectiveness and supportability of a new system. These methods and techniques are required to accomplish timely provisioning, and thereby ensure that support is ready when a system is fielded (10:18-1). The three specific methods include organic, conference team, and resident provisioning team. The method chosen for the F-15 acquisition, the aircraft

investigated in this research, was the resident provisioning team, called the Logistics Support Cadre (LSC).

Various techniques have also evolved to implement the detailed actions required to provision new systems. Three possible techniques include the accelerated provisioning concept, interim release, and spares acquisition integrated with production. The accelerated provisioning concept is a technique which combines provisioning order placement along with the provisioning conference (source coding and cataloging) to speed timely support (9:33-1). The second technique, interim release, gives long lead time item protection to the government, by allowing the contractor to begin procurement of critical or long lead time materials prior to production (8:15). Finally, Spares Acquisition Integrated with Production (SAIP) is a final technique used to combine order placement and production of identical spares that would otherwise be produced at a different time. SAIP minimizes the cost of spares and repair parts to the government by avoiding nonrecurring charges that would result from separate purchasing and manufacturing actions (8:7). After the provisioning strategy has been determined, the requirements of the strategy are defined in the provisioning section of the Request For Proposal (10:18-1). Figure 1 depicts a simplified outline of an initial provisioning process.

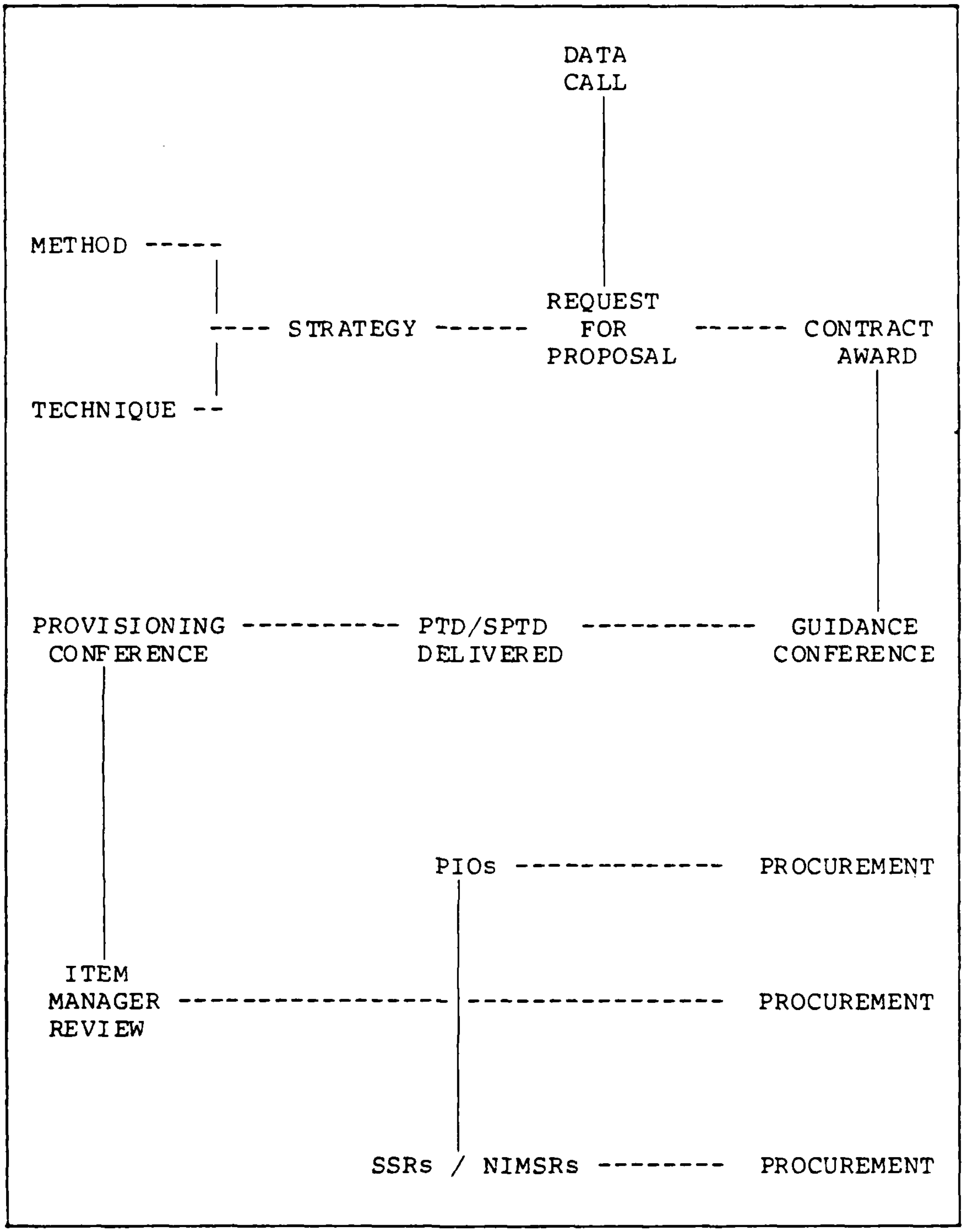

Figure 1. Simplified Initial Provisioning Process

After the provisioning strategy is developed the second ingredient, the formal provisioning process, begins with a data call made by the responsible program office (Figure 1). The data call is a letter to all appropriate functional specialists involved with the end item, requesting their provisioning data requirements. This provisioning data is then compiled for inclusion in the data requirements section of the Request For Proposal (32).

A guidance conference is then held, normally within 45 days of contract award. The conference is attended by representatives from AFLC, AFSC, the appropriate ALC, the using command, the contractor, and when necessary, the contractor's major vendors. The conference focuses on providing guidance to the contractor and establishing calendar dates which will become the contractual milestones for the delivery of the spares and repair parts (31:17).

After the guidance conference, the next major step is for the contractor to deliver Provisioning Technical Documentation (PTD). PTD is used to reference the various types of provisioning lists, logistics support analysis summary reports, and data processing cards or tapes. PTD is used by Department of Defense components for the identification, selection, and determination of initial requirements for support items to be procured through the provisioning process (7:3-1). The PTD will also include Supplemental Provisioning Technical Documentation (SPTD). SPTD is the

technical data used to describe parts or equipment. It consists of specifications, standards, drawings, photographs, descriptions and sketches. The SPTD also includes diagrams such as general arrangement drawings, schematics, and wiring or cabling diagrams needed to indicate the location or function of an item (7:2-2). Without adequate PTD and SPTD, follow-on and reprocurement action cannot occur.

Next, the provisioning conference occurs, which allows the government to make item selection and assign technical and management codes. The purpose of this process is to determine the range of items required for support. This includes maintenance factors such as recoverability status, and indicates to the user the source for supply support. Items selected at the conference are placed on the post-conference list and submitted to the item manager at the ALC for processing (9:16-1).

The item manager review is held at the responsible ALC to make sure PTD and SPTD submitted by the contractor are adequate to process the items. Participants include the item manager, cataloger, provisioner, and equipment specialists. Actions taken include spares requirements computations (in accordance with AFLCR 57-27), subcomponent review, stocklisting tasks, delivery schedule establishment and destination certification (10:19-1).

In general, items identified for spares acquisition fall into one of three categories:

1. Items already in the Air Force inventory.
2. Items already managed by another federal agency.
3. New items not stocklisted or managed in the federal supply system. (31:18)

Items that fall under the first category are processed separately. If an item is already managed by the Air Force it will normally not be acquired through the provisioning process. Rather, it will be identified to the responsible item manager that the system being provisioned will require the use of this new item. The item manager will then include the new forecast demand for the item in the regular requirements computation and acquisition process (31:18).

The process is somewhat more complex if the system is already managed by another federal agency (category 2). If the item is consumable, the Air Force communicates the new requirements through the use of a Supply Support Request (SSR). The SSR will automatically be forwarded to the managing activity. If the item is non-consumable (i.e. reparable), a Non-consumable Item Material Support Request (NIMSR) is forwarded to the managing activity. In either case, the managing activity is notified of the Air Force's forecasted need (31:18).

Items that fall into category three are not currently stocklisted or managed in the federal supply system and must be acquired through the provisioning process. The Provisioning Item Order (PIO) is the instrument for this acquisition. PIOs normally do not have a fixed price or a fixed delivery schedule. They are offered to the contractor with an estimated price and a desired delivery schedule. After acceptance, the contractor negotiates a final price and schedule with a government representative. This procedure increases the government's risk, but it also improves the timeliness of initial delivery because price and schedule negotiations do not delay actual placement of the spares order (31:19). Now that the spare and repair parts have been identified, the tools used to calculate the number of spare parts quantities will be examined.

Initial Requirements Determination

One of the methods used to determine the quantity of spares and repair parts is outlined in AFLCR 57-27, Initial Requirements Determination. This regulation states the policy and procedures for deciding which items qualify for stockage, and for computing new requirements for all types of initially provisioned items. AFLCR 57-27 applies to anyone in AFLC responsible for determining the initial spares levels for new Air Force weapon systems and end

items, either in production or under modification (13:1-1). Essentially, the regulation determines the range and depth of initial spares and support equipment required for a new system.

The determination of which items to stock (range) is covered in detail in Chapter One of AFLCR 57-27. The requirements computation (depth) for different types of authorized items is outlined in the remaining chapters. Chapter Three, Instructions for Initial Requirements Determinations of Recoverable (XD) Consumption Items, includes procedures that are relevant to the scope of this research. These procedures require the preparation of AFLC Form 614, Recoverable Items Requirements Computation Worksheet, for each authorized spare or repair part. Informative item data as well as computed data must be entered on this form. To streamline the time consuming manual process of preparing individual AFLC Form 614s for each item, simplified equations have been constructed that focus only on the mathematical operations required for initial provisioning computations (30). Appendix C presents these formulas.

The policy concerning the use of math models was recently changed by Interim Message Change 85-1 to AFLCR 57-27 dated 14 February 1985. Any math model that provides a different mix of inventory may be used if the model conforms to specific criteria as listed in the message. MOD-METRIC is one math model that meets all requirements.

MOD-METRIC

MOD-METRIC was developed by John Muckstadt to model the control of a multi-item, multi-echelon, multi-indenture inventory system. An "indenture" describes the relationship between an assembly and its sub-components, and "echelon" describes the repair levels (base and depot) for items in need of repair (26:472).

The MOD-METRIC technique considers the line replaceable unit (LRU) and the shop replaceable unit (SRU) relationship, and computes the effect of the SRU stock level on the availability of LRU's (16:1-2). An LRU is an item removed and replaced as a single unit from a weapon system or item of equipment (12:393). An SRU is a subcomponent of an LRU removed and replaced at a repair facility, and used to return the LRU to a serviceable condition (12:627). This two-echelon, two-indenture system is illustrated in Figure 2.

The basic objective of MOD-METRIC is to provide better support of aerospace systems by allocating limited resources in an optimal manner. It computes the best mix of reparable spare parts given a specified budget when the objective is to minimize backorders. A backorder is defined in MOD-METRIC as the expected number of unfilled demands or "holes" existing at the base level at any point in time (16:1-1).

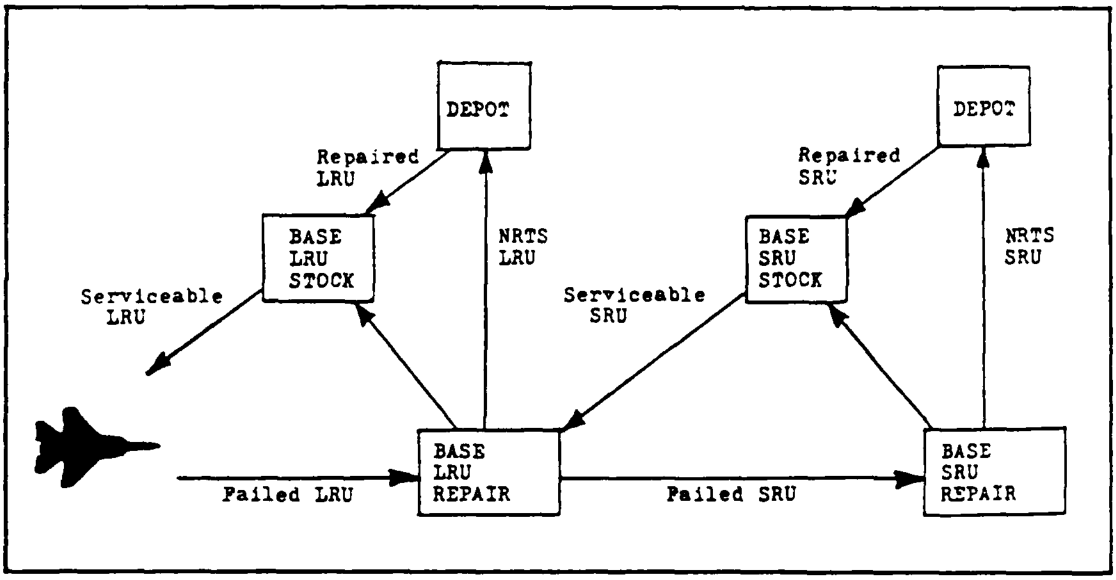

Figure 2. MOD-METRIC System (16:1-4)

MOD-METRIC provides a technique to compute the probability of an aircraft being grounded given a specified stock level, and incorporates marginal analysis in allocating money to the various LRUs and SRUs. Marginal analysis is a method that computes the increase in support per additional dollar invested (16:1-2).

As with all math models, MOD-METRIC is subject to certain assumptions. They include the following:

1. A stationary compound Poisson probability distribution describes the demand process for each item.
2. There is no lateral resupply between bases.
3. A failure of one type of item is statistically independent of those that occur for any other type of item.

4. Repair times are statistically independent.

5. There is no batching of items before repair is started on an item (infinite channel queuing assumption).

6. The level at which repair is performed depends only on the complexity of the repair (and not on existing workload).

7. No cannibalization takes place. (16:1-2)

MOD-METRIC completed the ground work for analyzing the two-echelon system consisting of a depot and several bases. A representation of the multi-echelon, multi-indenture inventory system was now ready to be adapted to model the behavior of a highly dynamic inventory environment (6:17).

Dyna-METRIC

Dyna-METRIC is an inventory model developed by The Rand Corporation and designed to help improve the management of Air Force multi-echelon, multi-indenture reparable items. It has been continually improved since its first release with version 2.1 in July 1980. The latest and most sophisticated version is 4.4, released in August 1984. It is pending official acceptance by HQ USAF/LEYS as the Air Force standard version (29). Because of significant improvements, this version is currently being used by a number of Air Force agencies and is the focus of this research.

Dyna-METRIC views each aircraft as a collection of spare parts, each with a probability of failure over a

period of flying time. Because each part is considered essential for mission accomplishment, a failed part must be replaced to maintain a fully mission capable (FMC) aircraft. The FMC aircraft can then be flown as needed during the scenario. If a failed part has no replacement available from base stock, the aircraft is considered not mission capable due to supply (NMCS) until the part becomes available. Similar to MOD-METRIC, the parts that compose the aircraft in Dyna-METRIC are multi-indentured. They consist of LRUs, SRUs and subSRUs, where subSRUs are now components of SRUs.

Dyna-METRIC can also model cannibalization. This is an important improvement over past methods, because in many maintenance systems cannibalizing is a common practice, particularly in cases where the repair is modularized as with LRUs and SRUs. In the model, cannibalization of parts from one aircraft to another is either accomplished as necessary for all items, (full cannibalization) or is restricted to only a few items (partial cannibalization) in support of the mission objectives (4;29). In the full cannibalization mode, an additional source of supply is provided when the stock is low or when service times are long. However, a few related issues are not considered in the model, such as aircrew availability, flight line support (fuel and munitions), and personnel support (food and medicine) (28).

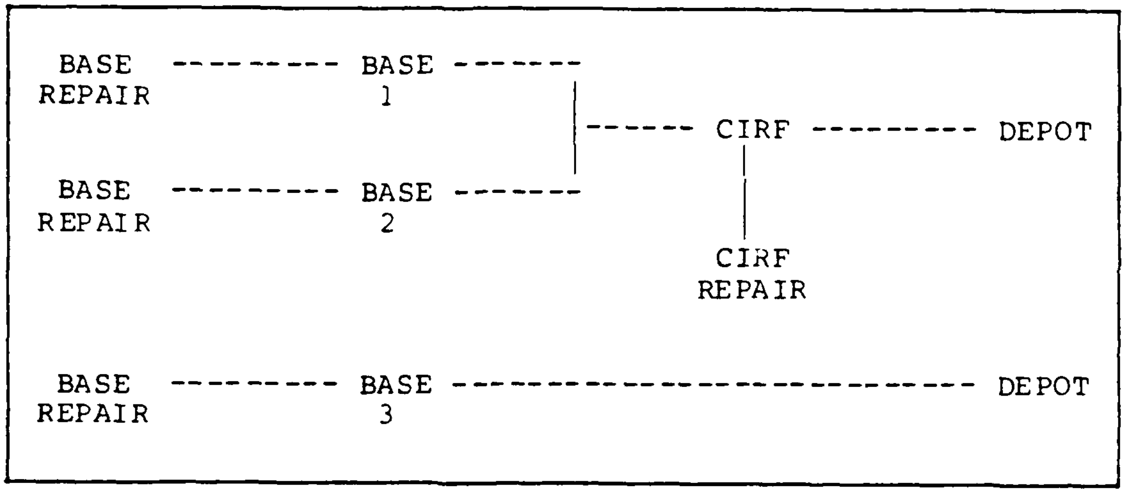

Figure 3. Dyna-METRIC View of the World
(Adapted from 2:3)

Dyna-METRIC is a three-echelon model consisting of multiple depots, Centralized Intermediate Repair Facilities (CIRFs), and operating bases. Dyna-METRIC can handle a variety of scenarios from a single base with its supporting depot to a multiple base, CIRF, and depot configuration. An example of possible structures is depicted in Figure 3.

In this example, there are three bases, each with its own repair facility. Two of the bases are augmented by a CIRF, while the third is not. In version 4.4, "complete" depot treatment is now possible, which means depot stock is no longer assumed to be unlimited. The user can limit the depot repair time, depot condemnation rate, and number of depot repairs each day (29). Additionally, each part can be identified with one or more of the supporting depots and the

corresponding transportation times. These capabilities make version 4.4 of the model even more realistic.

The lines in Figure 3 represent the flow of parts (pipeline) to and from the various facilities. Dyna-METRIC calculates the expected number of components in each pipeline for each day and for each segment of the scenario, using daily demands and process delay times defined by the user. These process delay times are composed of local repair times and transportation times. The sum of all pipeline segments is the key parameter used to compute the probability (typically Poisson) that a given number of components are in repair or on order (28:vii). Dyna-METRIC computes the probability distribution of all pipeline segments using an expansion of Palm's Theorem developed by Hillestad and Carrillo (22). Figure 4 summarizes the basic mathematical theory used in Dyna-METRIC. A complete treatment of the mathematics is contained in Hillestad (21).

The equation centers on the demand function M(s) and the repair function 1 - F(s,t) with several variables used to describe the pipeline and provide limits on the repair distribution. By using this theory, the model captures dynamic demands and transient behavior generally associated with flying and sortie surges.

Given:

Service Function $F(s,t)$ = the probability that a component entering repair at time s has completed the service by time t.

Repair Function $1 - F(s,t)$ = the probability that a component entering repair at time s is still in repair at time t.

Demand Function $M(s)$ = the components repair demand rate at time s.

Demand Function = (failures per flying hour) *
(flying hours per sortie at time t) *
(sorties per day per aircraft at time t) *
(number of aircraft at time t) *
(quantity of the component on the aircraft) *
(percentage of aircraft with the component)

Then: The expected number of components L, in the repair pipeline at time t is:

$$L(t) = \int_{0}^{t} (1 - F(s,t)) * M(s)\, ds \qquad [1]$$

Restated: The expected number of any one type component in repair at time t is a function of all demands for that component and the capability to repair it during the elapsed time period.

Figure 4. Basic Dyna-METRIC Equation (21;22)

Unlike its predecessors, the probability distributions for all components in the pipeline can then be combined to estimate aircraft availability, fully mission capable aircraft, sorties, and expected backorders from not fully mission capable aircraft (28:vii).

Several limitations arise from the mathematical assumptions, approximations, and program implementation constraints in Dyna-METRIC. These limitations reflect the tradeoffs between current "state-of-the-art" inventory systems and computational resources (computer time and memory) needed to use the model (28:14). The following is a list of the eight most frequently noted limitations the user should consider when determining the application of the model to any given situation:

1. Unconstrained repair may overestimate or underestimate performance, because demands are required to arrive randomly according to a probability distribution (typically Poisson). Repair and transportation times have a known probability distributions that are independent.

2. Lateral resupply is not modeled explicitly.

3. Aircraft deployed at each base are nearly identical.

4. Constrained repair computations are only approximate.

5. Ordering policies for economic order quantities are not modeled.

6. Expected backorders and awaiting parts quantities approximate additive pipelines because the model does not compute joint probability distributions for them.

7. Flightline and operational constraints are not explicitly modeled.

8. Real computers limit the model's precision and accuracy because they have finite computational precision. (23:14-20)

Even though these eight limitations of Dyna-METRIC appear extensive, it is one of the latest and most sophisticated reparable inventory models used by the Air Force. The logic and accuracy of the model have been fully verified and validated against real world flying operations (4).

III. Methodology

Overview

The overall objective of this research was to compare different methods for computing initial spares requirements. Currently, the initial provisioning process employs AFLCR 57-27 and MOD-METRIC to compute initial spares requirements. Because of changing flying requirements and phase-in of new items, the initial provisioning period of service is very dynamic. This dynamic environment requires an equally dynamic model to forecast spares requirements. For this study, Dyna-METRIC was chosen as an alternative to current methods because it was designed to capture the changes that take place in a dynamic wartime environment.

To accomplish the research objectives two basic ingredients were necessary. First, a realistic initial provisioning scenario and spare parts data were needed to provide a foundation for model comparisons. Data acquired from the original FY 73 and FY 74 acquisition of the F-15 satisfied this requirement for two reasons: 1) the system was originally provisioned using MOD-METRIC and, 2) most of the actual planning data was available. The second ingredient necessary to accomplish the research objectives was the formulation of an experimental design and research

procedure. A comparative analysis technique was chosen to assess the similarities and differences between stock levels and aircraft availabilities when the budget was held constant. This research will demonstrate the utility of Dyna-METRIC in initial provisioning, and will support it as an alternative to present methods.

Scenario and Data Base

McDonnell Aircraft Company (MCAIR), St. Louis Missouri, provided the unclassified scenario and data base for this research. The F-15 Item Manager provided the AFLC Form 27 (Programming Checklist), revision number two, dated 28 June 1972. The Programming Checklist contained the total planned aircraft deliveries and flying hours over the two year initial provisioning period for FY 73 and FY 74. A reconstruction of monthly planned flying hours and aircraft deliveries was developed through interviews with Mr. Wayne Lyle, Logistics Engineering Manager, MCAIR. During the initial provisioning period, Mr. Lyle, then Lieutenant Colonel Lyle, was the Chief of the Logistics Support Cadre (LSC). He was responsible for the initial provisioning requirements for the F-15, and used MOD-METRIC as the primary determinant of initial spares procurement quantities (24). He provided the MOD-METRIC LRU input data and output quantity listings, dated 21 November 1973, for one subsystem

of the F-15, the fuel system. The fuel system, consisting mainly of pumps and valves, sufficiently exercised each of the computational techniques studied in this research, and thus provided a representative system for comparison.

Mr. Les Willis, the Senior Production Support Analyst for MCAIR, provided three critical pieces of information. First, he provided the input data from the initial provisioning period necessary to reconstruct the AFLCR 57-27 computations. Second, he provided the actual equations from AFLCR 57-27 used to calculate the initial provisioning requirements for FY 73 and FY 74. These equations simplified the computational task involved by eliminating the need to complete AFLC Form 614 for each item. Third, he provided a formula used by MCAIR to adjust the AFLCR 57-27 quantities based on a given confidence level. The equations and confidence level formula are discussed in Appendix C.

Scenario. One hundred and seven aircraft were planned for delivery during the two year initial provisioning period. The scenario required the aircraft to be delivered to two bases having one supporting depot. The first year, 30 aircraft were to be delivered to Luke AFB (Base 1) and were to fly a total of 5400 hours. The second year six aircraft were to be transferred from Luke to Langley AFB (Base 2). The remainder of the 77 aircraft were to then be delivered to Langley AFB. The hours to be flown for the second year totaled 37,400 hours (see Table I).

TABLE I

FLYING PROGRAM

	LUKE AFB (Base 1)		LANGLEY AFB (Base 2)	
MONTH	AIRCRAFT	HOURS	AIRCRAFT	HOURS
1	2	54	0	0
2	5	135	0	0
3	7	189	0	0
4	10	270	0	0
5	12	324	0	0
6	15	405	0	0
7	17	459	0	0
8	20	540	0	0
9	22	594	0	0
10	25	675	0	0
11	27	729	0	0
12	30	810	0	0
FY 73 HOURS		5184	FY 73 HOURS	0
13	24	1008	12	540
14	24	1008	18	810
15	24	1008	25	1125
16	24	1008	31	1395
17	24	1008	38	1710
18	24	1008	44	1980
19	24	1008	50	2250
20	24	1008	57	2565
21	24	1008	63	2835
22	24	1008	70	3150
23	24	1008	76	3420
24	24	1008	83	3735
FY 74 HOURS		12096	FY 74 HOURS	25515

Flying Program Total Hours: 42795

FORM 27 Total Hours: 42800 (within .1 percent)

Source: (28)

Database. In addition to the flying hour program, each model required other specific input data. For the first method of computation, MOD-METRIC, Mr. Lyle provided the input data which comprised the F-15 fuel system. This input data, used throughout this research, consisted of 41 LRUs and their associated characteristics. The LRU input data characteristics included work unit code (WUC), part number, unit cost, mean time between demand (MTBD), not reparable this station (NRTS) percent, condemnation (COND) percent, quantity per aircraft (QPA), base repair time (BRT), depot repair time (DRT), and monthly production lead time (PLT). The input for the flying hour program consisted of only one value per base due to the nature of the MOD-METRIC program. This value was the peak monthly flying hours, 1008 hours for Luke and 3735 hours for Langley. A 14 day order and ship time (OST) was taken from AFLCR 57-4 (15:1-7), and was used as a standard input for each computational method. Appendix B contains the MOD-METRIC input data file.

The AFLC 57-27 computations, the second method analyzed, required inputs from both Mr. Willis and the MOD-METRIC LRU input data. Mr. Willis provided the procurement cycle safety level (PCSL), the average month program (AMP), and the peak month program (PMP) values for each year of the provisioning period. Other values needed in the 57-27 equations were taken from the MOD-METRIC LRU input data. For example, the maintenance repair factor (MRF) is defined

as 100 divided by the MTBD. The depot condemnation repair (DCR) is the condemnation percent if the part is condemned at the depot, or the base condemnation repair (BCR) if the part is condemned at the base.

The third method of computing stock requirements used Dyna-METRIC in the requirements mode with the same flying program and LRU input data. Due to the dynamic nature of Dyna-METRIC, the flying program was more accurately portrayed by modeling a monthly change to the aircraft levels and flying hours. Three values needed for Dyna-METRIC were demands per flying hour (DPFH), PLT, and desired aircraft availability. DPFH is defined as the inverse of the MTBD and assumed to follow a Poisson distribution as mentioned in Chapter II. The PLT needed only to be expressed in days versus months.

Aircraft availability was taken from a table printed as part of the MOD-METRIC output. Even though the aircraft availability was listed as an approximation, the formula used to arrive at the availability values is an expansion of the formula used in Dyna-METRIC when purchasing base LRU stock to a no cannibalization policy (20;23). A detailed derivation, explanation, and tests supporting this formula are found in Fisher and others (18). This procedure has an accepted application found in other research work (25:33). Therefore, the MOD-METRIC availability calculation was used as the availability input constraint for the requirements

mode of Dyna-METRIC. Appendix D contains the Dyna-METRIC input data file.

Experimental Design

The general design used to solve this research problem was a comparison of various stock levels and aircraft availabilities. The experimental design supported the research objectives by displaying the similarities and differences between the computational methods used in initial provisioning. This comparative technique was chosen to portray the facts as clearly, simply, and accurately as possible. The comparison was assessed at two levels. The first level involved an analysis between stock quantities produced by each method. Figure 5 outlines this design.

The second column of Figure 5 lists the original MOD-METRIC stock levels when the entire weapon system was modeled in November 1973. The next column is for MOD-METRIC using only the fuel system LRUs constrained to the November 1973 MOD-METRIC total cost. The fourth column is for straight AFLCR 57-27 calculations. Column five adjusts the AFLCR 57-27 quantities by varying the MCAIR confidence level to meet the FY 73 MOD-METRIC total cost. The last column lists Dyna-METRIC stock levels when the confidence level is again varied to meet the FY 73 MOD-METRIC total cost.

TABLE II

STOCK LEVEL QUANTITIES

WORK UNIT CODE	FY 73 MOD-METRIC	MOD-METRIC	BASIC AFLCR 57-27	ADJ. AFLCR 57-27	DYNA-METRIC
Item 1 . . . Item 41					
TOTAL QUANTITY					
TOTAL COST					

Figure 5. Initial Spares Requirements Computation

The values used to vary the confidence level for AFLCR 57-27 and Dyna-METRIC are presented in Chapter IV.

The second level of analysis addressed the performance capability of each stock option when evaluated for weapon system readiness. The evaluation tool chosen to accomplish this comparison was the Dyna-METRIC model, but this time operated in the assessment mode. The Dyna-METRIC model was selected as the evaluation tool because of its sophistication and dynamic ability to model real world events. Figure 6 presents the design used to display the aircraft availability for each method at 90 day intervals over the two year initial provisioning period.

TABLE IV

STOCK LEVEL PERFORMANCE
(Percent of FMC Aircraft)

	FY 73 MOD-METRIC		MOD-METRIC		BASIC AFLCR 57-27		ADJ. AFLCR 57-27		DYNA-METRIC	
	CANN.		CANN.		CANN.		CANN.		CANN.	
DAY	FULL	NO	FULL	NO	FULL	NO	FULL	NO	FULL	NO
90										
180										
.										
.										
.										
720										

Figure 6. Aircraft Availability

The stock level performance will be displayed for both a full and no cannibalization policy to identify a range of expected aircraft availability. In general, a no cannibalization policy underestimates capability, while a full cannibalization policy overestimates capability (29).

Research Procedure

After acquiring the data provided by MCAIR, the first step to ensure consistency was to rerun the MOD-METRIC model using the fuel system LRU input data and the reconstructed flying hour program. This was done for two reasons. First, the reconstructed flying hour program was not guaranteed to

contain the exact values used in the November 1973 MOD-METRIC runs. The second, and main purpose of rerunning the MOD-METRIC model was to eliminate any variance in the marginal analysis tradeoff the model performed as it purchased stock. The original MOD-METRIC analysis optimized the purchase of stock across the entire weapon system, and any change to the number of spare parts analyzed would affect the mix of the stock quantities produced (4;24). By correcting for the selection of only the 41 LRUs that comprised the fuel subsystem, and using a common flying hour program, this step ensured a fixed baseline for comparison between the three methods of computation analyzed.

The next step was to choose an investment constraint. The output from MOD-METRIC provided a series of tables showing different investment levels for a given set of LRUs. The user would select the appropriate budget level desired, which would indicate a stock level for that total cost. The budget chosen for this study was the cost of the fuel system stock produced by the November 1973 MOD-METRIC run. This budget was used as the investment constraint for each method.

The third step was to calculate the AFLCR 57-27 stock levels using the equations and values provided by Mr. Willis. To achieve this, a spreadsheet was developed (see Appendix C). The spreadsheet had the capability to calculate both the basic AFLCR 57-27 values and the adjusted

AFLCR 57-27 values based on a confidence level input. The confidence level for the adjusted AFLCR 57-27 calculations was increased until the stock level met the investment constraint. Because AFLCR 57-27 calculations were a yearly quantity, the total stock level was the sum for each year of the two year initial provisioning period.

The fourth step of the research approach was to run the Dyna-METRIC model in the requirements mode. The options selected for the requirements mode purchased both depot and base stock under a given confidence level and desired aircraft availability. The aircraft availability, as mentioned earlier, was the value obtained from the MOD-METRIC output. The confidence level, however, was varied until the total cost met the investment constraint. The results from each method are presented in tabular form in Chapter IV.

An evaluation of the computed stock levels was the final step in this research approach. Dyna-METRIC was run in the assessment mode to provide performance measures of the different methods using the various stock levels. Since Dyna-METRIC provides the performance measures for a maximum of nine points in time, the comparison of each stock level was performed at 90 day intervals over the two year initial provisioning period. The results of this second comparison are also presented in Chapter IV.

Results of this methodology are expected to produce data in terms of stock quantity and aircraft availability.

The data will be evaluated by comparing the absolute difference of the values produced. The research procedure is diagrammed below in Figure 7.

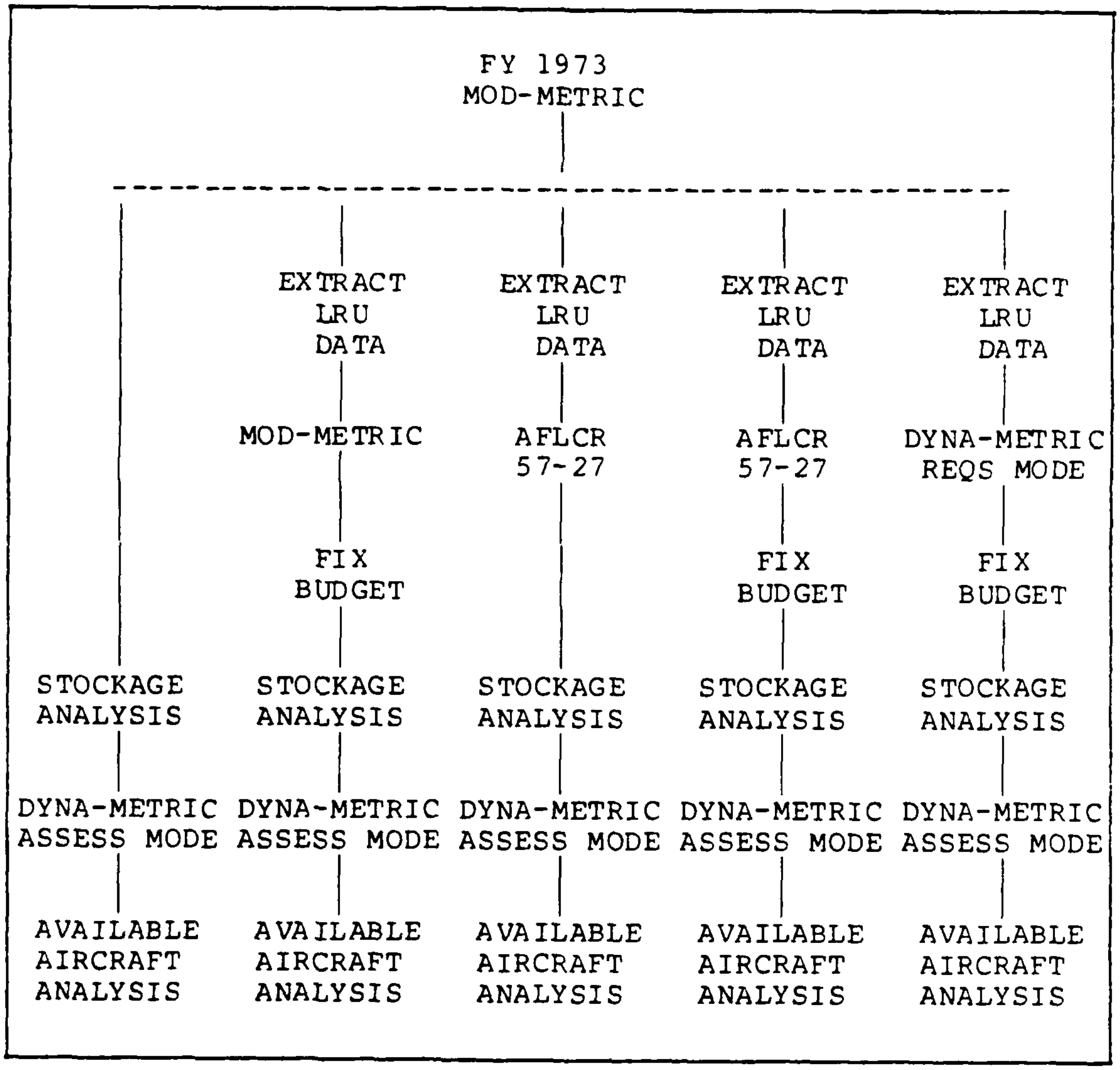

Figure 7. Research Procedure

IV. Results and Analysis

Overview

Three methods of computing initial spares requirements were outlined in Chapter III. The results are now presented in tabular form for ease of comparison. The three methods were assessed in two areas, 1) requirements computation, or stock level quantity and, 2) performance, or aircraft availability. The purpose of Table II is to display the similarities and differences of requirements computations across each fuel system LRU when constrained to the FY 73 MOD-METRIC budget. Table IV is used to evaluate the requirements computations for performance based on the percent of fully mission capable (FMC) aircraft. This evaluation is presented in 90 day intervals over the two year initial provisioning period using the assessment mode of Dyna-METRIC.

Two tables of comparative data were added from the design described in Chapter III tc focus on the relationship between MOD-METRIC and Dyna-METRIC. These comparisons are presented in Table III and Table V. The purpose of Table III is to expand on the data contained in Table II (stock levels), and reveal the critical relationship between item cost and failure rate. On the other hand, the purpose of

Table V is to display additional information, in the form of total backorders, under the performance area or aircraft availability. Together, these tables will satisfy the research objectives and answer the research problem outlined in Chapter I.

Presentation and Analysis of the Stock Level Quantities

As noted previously, the three different methods used to compute the initial spares requirements were the MOD-METRIC computer program, AFLCR 57-27 computations, and the Dyna-METRIC computer program. Table II presents the stock level quantities computed by these three methods across 41 LRUs of the F-15 fuel system. To help in the comparative analysis of the stock level quantities, additional information has been added to Table II. This information includes the LRU cost, mean time between demand (MTBD), and quantity per aircraft (QPA) used as input to each of the three methods.

The MOD-METRIC program has two columns of stock level quantities listed in Table II. The first MOD-METRIC column contains the November 1973 quantities taken directly from the MOD-METRIC printouts used in the initial provisioning of the F-15 aircraft. The total cost of $364,867 for the 41 fuel system LRUs provides the investment constraint designated for this research.

TABLE II

STOCK LEVEL QUANTITIES

WUC	COST	MTBD	QPA	FY 73 MOD-METRIC	MOD-METRIC	BASIC AFLCR 57-27	ADJ. AFLCR 57-27	DYNA-METRIC
46AAA	350	11000	2	13	13	2	8	9
46AAK	420	25000	1	8	7	0	3	5
46AAL	240	35000	1	8	7	0	3	4
46AAM	350	11000	1	10	10	1	5	7
46AAV	554	11000	1	8	8	1	4	6
46AAW	2900	60000	2	4	2	0	3	2
46AAX	547	25000	1	6	6	0	3	5
46AAY	240	35000	1	8	7	0	3	4
46ABD	547	25000	2	8	8	1	4	5
46ABE	240	35000	2	9	8	0	3	4
46ABF	547	25000	1	6	6	0	3	5
46ABG	240	35000	1	8	7	0	3	4
46ACA	1956	1250	1	12	17	7	17	20
46ACB	467	14000	1	8	8	1	4	5
46ACG	1005	8333	1	8	7	1	4	5
46ACP	911	13000	1	7	7	1	4	5
46ADD	720	7000	1	9	9	1	5	8
46ADE	5412	13000	1	2	1	0	3	2
46ADG	1300	38824	2	6	5	0	3	4
46ADK	350	1000	1	19	28	10	23	28
46ADN	1732	3300	1	9	10	2	9	11
46ADP	554	11000	1	8	8	1	4	6
46ADR	685	11000	1	8	8	1	4	6
46ADS	685	11000	1	8	8	1	4	6
46AEA	5486	2200	1	8	8	2	9	11
46AEC	4059	3700	1	5	4	1	5	5
46AEE	1467	3846	1	8	9	1	7	9
46AEF	1282	3700	1	7	7	1	5	6
46BAA	10300	2000	3	5	5	2	9	5
46BBA	260	50000	1	6	5	0	1	4
46BBB	183	20000	3	10	10	1	5	6
46BBC	359	25000	1	8	7	0	3	5
46BBE	651	35000	1	6	5	0	3	4
46BCA	826	10000	2	10	10	1	7	8
46BCB	1800	8333	3	9	11	3	10	9
46BCC	170	40000	1	8	7	0	2	4
46BCF	261	18000	1	8	8	0	3	5
46BCH	360	10000	1	8	8	1	4	6
46BCL	501	6624	4	15	23	7	19	17
46DAC	1318	7059	1	8	7	1	5	6
46DAD	3130	6200	1	6	5	1	5	6
TOTAL QUANTITY				335	344	53	231	282
TOTAL COST				$364,867	$363,742	$81,439	$364,287	$363,815

To maintain the integrity of the comparative analysis, the MOD-METRIC program was rerun using only the fuel system LRUs as input, and constrained to the FY 73 total cost.

The second column for MOD-METRIC in Table II contains the rerun stock level quantities computed for an investment of $363,742. These stock level quantities were chosen because in the next iteration of MOD-METRIC, the model purchased one more LRU 46AEA, forcing total cost over the designated investment constraint.

The main purpose of rerunning MOD-METRIC with the fuel system LRUs was to eliminate any variance in the marginal analysis tradeoff the model performed as it purchased stock. In FY 73, the entire weapon system was modeled to obtain the mix of spare parts for a total weapon system investment. This resulted in the tradeoff of parts across all systems, not just the fuel system LRUs. In the fuel system only run, a difference in the marginal analysis tradeoff occurred because funds were distributed across only 41 LRUs. LRU 46ACA, 46ADK, and 46BCL are a good example of this difference, because they have a stock quantity greater than five or more over the FY 73 MOD-METRIC quantity. Note that LRU 46ACA and 46ADK have the lowest MTBD rate of any item whereas LRU 46BCL has the largest QPA of any item.

In addition, MOD-METRIC tends to buy more low cost items when compared to the other methods of computation. This is the result of MOD-METRIC adding the item to

inventory that reduces backorders the most per dollar invested (6). As an example, MOD-METRIC purchased double the number of LRU 46AAL, 46AAY, 46ABG, 46BBB and 46BCC (the least expensive items) and increased the total quantity of parts by at least 50 items as compared to either Dyna-METRIC or the adjusted AFLCR 57-27.

AFLCR 57-27 was the second method used to compute spares requirements. The AFLCR 57-27 calculations attempt to fill the transportation pipeline with spare parts during the initial stages of a new weapon system (24). These spares are required to support minimum supply times and to obtain the optimum initial support from available sources (13:1-1). Table II contains two columns for AFLCR 57-27 computations. The first column lists the basic AFLCR 57-27 stock level, while the next column is for the adjusted AFLCR 57-27 stockage posture.

A spreadsheet was developed and validated by Mr. Willis, Senior Production Support Analyst for MCAIR, to ensure accuracy in calculating the AFLCR 57-27 values (Appendix C). The stock levels from the basic AFLCR 57-27 computations resulted in quantities that cost $81,439, far less than the budget of $364,867. To increase this basic stock level, a confidence level formula provided also by Mr. Willis was used to adjust the quantity of parts to reach the investment constraint. A standard deviation with the value of 3.28 was used for the adjusted AFLCR 57-27 computations,

resulting in an investment of $364,287. This indicates the model bought the mean quantity desired for each part, plus enough to equal 3.28 standard deviations from the mean quantity. This standard deviation implies a 99.95 percent confidence level, assuming a normal distribution. The standard deviation of 3.28 was used in the calculations, because the next increment, a value of 3.29 resulted in an increase of expenditure to $374,587, well over the designated investment constraint.

The formulas used to calculate the initial spares requirements are also contained in Appendix C. Each item computed under AFLCR 57-27 is considered independent from all other items in a weapon system (24). Therefore, these formulas do not reflect any type of marginal analysis tradeoff between parts of a system. LRU 46BAA is a good example of how marginal analysis can be used to control over purchasing of a component in an interdependent system. The adjusted AFLCR 57-27 computations for LRU 46BAA resulted in nine parts at an individual cost of $10,300 (the most expensive item). This quantity is double the number computed by either of the other two methods and reflects an additional expenditure of $41,200 for that part alone.

The final method of initial spares requirements computations, and the focus of this research, was Dyna-METRIC. To meet the designated investment constraint, a Dyna-METRIC confidence level of .9989 resulted in the stock levels shown

in Table II for a total cost of $363,815. These stock level quantities where chosen because the next higher confidence level of .9990 resulted in an investment of $369,656, which is over the designated investment constraint.

Dyna-METRIC, similar to MOD-METRIC, also seeks to limit costs, but in a different fashion. The marginal analysis used in Dyna-METRIC adds the item to inventory that gives the greatest increase in aircraft availability (21:64). Because component failures are based on the number of flying hours, the failure rate (inverse of MTBD) is a strong determinant in identifying parts needed to support the weapon system. LRU 46ACA, 46ADK and 46AEA have the lowest MTBD, or highest failure rates, resulting in the highest quantity purchased as compared to either MOD-METRIC or AFLCR 57-27.

Table III was used to further the comparison between MOD-METRIC and Dyna-METRIC inventory models by focusing on the relationship between item cost and failure rate. The 41 LRUs were sorted by cost from low to high, and then resorted by MTBD from low to high. (Note: a low MTBD equates to a high failure rate.) Because a clear relationship between item cost and failure rate is evident in LRUs with extreme values, the median values were discarded and the relative range for this comparison was established (see Table III).

TABLE III

DYNA-METRIC VERSUS MOD-METRIC
STOCK LEVEL QUANTITIES

FAILURE RATE

COST		LOW (MTBD > 30000)			HIGH (MTBD < 7000)		
		WUC	MOD-METRIC	DYNA-METRIC	WUC	MOD-METRIC	DYNA-METRIC
C	HIGH ($ > 1900)	46AAW	2	2	46ACA	17	20
O					46AEA	8	11
S					46AEC	4	5
T					46BAA	5	5
					46DAD	5	6
	LOW ($ < 400)	46AAL	7	4	46ADK	28	28
		46AAY	7	4			
		46ABE	8	4			
		46ABG	7	4			
		46BBA	5	4			
		46BCC	7	4			

The LRU relationship resulted in a matrix with four quadrants. The quadrants contain items with:

1. Low cost / low failure rate.
2. High cost / low failure rate.
3. High cost / high failure rate.
4. Low cost / high failure rate.

Dyna-METRIC consistently purchased a quantity of parts less than MOD-METRIC for low cost/low failure rate LRUs. At

the same time, however, Dyna-METRIC purchased equal to or greater than the quantity of parts purchased by MOD-METRIC for high cost/high failure rate items. This relationship demonstrates the practicality of Dyna-METRIC, which purchased more items having high failure rates (affecting aircraft availability), and less items when failure rates were low and less critical.

A major decision in logistics management is the cost of stocking an item versus the cost of not stocking an item (4). When the cost to stock is greater than the cost not to stock, fewer parts should be purchased. This relationship is identified in Table III under the quadrant for high cost/low failure rate. Both Dyna-METRIC and MOD-METRIC purchased relatively few of LRU 46AAW, because it would be costly to hold for it´s long MTBD. Conversely, when the cost not to stock is greater than the cost to stock, more parts should be purchased. Again, both Dyna-METRIC and MOD-METRIC purchased large quantities of LRU 46ADK, because of it´s low cost and high failure rate. Therefore, Dyna-METRIC performed equally well compared to MOD-METRIC when the decision to stock versus not stock was required, and better than MOD-METRIC when aircraft availability was involved. The next section discusses the performance of the recommended stock level quantities.

Presentation and Analysis of Stock Level Performance

Dyna-METRIC, operated in the assessment mode, was used as the evaluation tool for determining performance in terms of aircraft availability for the three methods studied (see Table IV). Five Dyna-METRIC assessment mode runs were performed. Each used as input the stock level quantities from one of the methods shown in Table II.

Several performance measures were provided by the Dyna-METRIC output for each day analyzed. These measures included the probability of achieving a target not fully mission capable (NFMC) rate, the probability of achieving a target sortie rate, the expected number of fully mission capable (FMC) aircraft at a specified degree of confidence, the expected number of NFMC aircraft, the expected percent of aircraft that were NFMC, and the expected number of sorties flown. These values were computed at the end of each day of analysis, and displayed under the performance section in the Dyna-METRIC printout for both full cannibalization and partial cannibalization policies. Since cannibalization was not allowed on any LRU, the measures computed under the Dyna-METRIC output heading of "partial cannibalization" actually reflect the values for a no cannibalization policy (23:11).

The percent of FMC aircraft is the only performance value displayed in Table IV. This value provides an

aircraft availability measure that can be used for comparison between the changing flying program and aircraft levels, and it is one of the most important logistics objectives to the operational forces (28:22). Table IV includes this performance measure for both full and no cannibalization policies, because cannibalization has a significant effect on the performance of a stockage posture (1:1-25). The values for the percent of FMC aircraft were computed from Dyna-METRIC output for each 90 day interval, by subtracting the expected percent of NFMC aircraft from the value of 1.000.

Under full cannibalization, failed components at each base were instantly consolidated to the fewest possible aircraft, resulting in the generation of as many FMC aircraft as possible. For no cannibalization, the removal of a properly functioning component from a broken aircraft to repair another aircraft did not take place. The performance measures were very sensitive to the cannibalization policy, and the first sign of a performance shortfall was displayed under no cannibalization (23:11).

The performance of MOD-METRIC in Table IV consistently resulted in high aircraft availability. However, a potential stockage problem may exist at day 720 where the percent of FMC aircraft drops off to .987 under the no cannibalization policy.

TABLE IV

STOCK LEVEL PERFORMANCE
(Percent of FMC Aircraft)

	FY 73 MOD-METRIC		MOD-METRIC		BASIC AFLCR 57-27		ADJ. AFLCR 57-27		DYNA-METRIC	
	CANN.		CANN.		CANN.		CANN.		CANN.	
DAY	FULL	NO	FULL	NO	FULL	NO	FULL	NO	FULL	NO
90	1.00	1.00	.998	.998	.941	.927	1.00	1.00	.998	.998
180	1.00	1.00	.997	.997	.951	.920	.999	.999	.998	.998
270	1.00	1.00	.996	.996	.959	.914	.999	.999	.997	.997
360	1.00	1.00	.996	.995	.966	.910	.999	.999	.997	.997
450	1.00	1.00	.996	.996	.954	.851	.998	.998	.996	.995
540	.999	.999	.997	.996	.959	.821	.998	.998	.995	.995
630	.997	.997	.997	997	.957	.788	.997	.997	.994	.993
720	.990	.987	.997	.987	.951	.751	.996	.995	.993	.991

The performance of the basic AFLCR 57-27 stock levels quickly deteriorated because of the limited amount of stock purchased for an investment of $81,439. This lower dollar investment is 78 percent less than the designated investment constraint of $364,867. Under full cannibalization, the percent of FMC aircraft decreased to .941 by the first day of analysis (day 90). Because broken aircraft become an additional source of supply under full cannibalization, the percent of FMC aircraft was stable for most of the two year initial provisioning period. However, cannibalization

resulted in an average reduction in mission capability of 5 percent.

Under AFLCR 57-27 with no cannibalization, the percent of FMC aircraft continued to decrease throughout the two year period, down to .751. This is a reduction in mission capability of 25 percent, and clearly shows that under a no cannibalization policy (the most restrictive), a decrease in the dollars invested does not result in a linear or proportional decrease in aircraft availability. Restated, a decrease in the budget of a given percentage does not result in an equal decrease in percentage of FMC aircraft.

As a final evaluation of Table IV, the adjusted AFLCR 57-27 and Dyna-METRIC stock levels consistently performed well throughout the two year period at a rate of .990 or better under both full and no cannibalization policies. No performance shortfalls were evident in either stockage posture.

Table V was included under the stock level performance evaluation to further highlight the relationship between MOD-METRIC and Dyna-METRIC. The stock levels produced by each method in turn led to the total backorders displayed in Table V for each 90 day interval. Specifically, at day 720 only .97 units were backordered for Dyna-METRIC and .37 units were backordered for MOD-METRIC. This compares favorably, for example, to the 30.46 units which would have been backordered using the basic AFLCR 57-27 model.

TABLE V

TOTAL BACKORDERS

DAY	FY 73 MOD-METRIC	MOD-METRIC	BASIC AFLCR 57-27	ADJ. AFLCR 57-27	DYNA-METRIC
90	0.00	0.02	0.53	0.00	0.01
180	0.00	0.05	1.25	0.01	0.03
270	0.00	0.09	1.98	0.02	0.06
360	0.01	0.15	2.82	0.04	0.10
450	0.02	0.22	7.91	0.09	0.24
540	0.06	0.24	13.35	0.15	0.37
630	0.30	0.28	20.68	0.28	0.59
720	1.37	0.37	30.46	0.53	0.97

Dyna-METRIC, therefore, in addition to adding the item to inventory that yielded the greatest increase in aircraft availability, also succeeded in minimizing total backorders nearly as well as MOD-METRIC.

The main goal of this research, to assess The Rand Corporation's Dyna-METRIC inventory model for computing initial spares levels, has been accomplished. The results of this comparative analysis indicate that the Dyna-METRIC model met or exceeded the performance of the other methods of initial spares requirements computations when constrained to the same investment. The conclusions and recommendations drawn from the research results are presented in Chapter V.

V. Summary, Conclusions and Recommendations

Summary of Research Effort

The goal of initial provisioning is to provide the highest level of readiness for a fixed level of investment. The problem then, is to find a strategy for acquiring spares that will provide a specified level of weapon system availability, at the least total cost. Currently, two methods are authorized by AFLCR 57-4 to compute the mix of spares for initial provisioning: MOD-METRIC and AFLCR 57-27. These traditional methods determine the mix of spares without considering aircraft readiness. On the other hand, Dyna-METRIC, an availability model, quantifies the number of spares needed and finds the optimal mix for a dynamic (wartime) scenario.

Through the use of an accurate initial provisioning data base and scenario, a comparative analysis technique was applied to study results from MOD-METRIC, AFLCR 57-27, and Dyna-METRIC computations at two levels. First, the requirements computation (stock level) for each method was analyzed for similarities and differences. At the second level, the stock levels computed by each method were evaluated for their impact on aircraft availability (percent of FMC aircraft) over a two year initial provisioning scenario.

Conclusions

The first method for computing initial spares requirements was MOD-METRIC. The decrease in performance to MOD-METRIC's lowest value of .987 on day 720, is of minimum consequence for two reasons. First, changes and adjustments during the initial provisioning would have necessitated the reaccomplishment of MOD-METRIC with updated information. Secondly, by day 720, the initial provisioning of F-15 support would have transitioned into a more standardized support configuration (replenishment), which would have more accurately approximated the normal supply support system. Therefore, MOD-METRIC marginal analysis tradeoff of cost versus expected backorders resulted in a successful initial provisioning (high aircraft availability) during a period of acquisition generally characterized by uncertainty and financial limitation.

The stock levels produced, however, by the basic AFLCR 57-27 resulted in a dramatically reduced investment and the poorest performance of the three methods. AFLCR 57-27 is a simple deterministic model that calculates only the mean or average quantity of parts needed, in an attempt to fill the pipeline. Therefore, AFLCR 57-27 resulted in a shortfall in performance, ranging from 5 to 25 percent, for the two year initial provisioning period.

The final method, Dyna-METRIC, provided a mixture of spare parts that resulted in a consistently high level of aircraft availability (greater than 99 percent) throughout the two year scenario. Two basic conclusions can be drawn from the results shown in Chapter IV. The first conclusion is Dyna-METRIC performed equal to, or better than MOD-METRIC in this analysis. They both tended to stock equal amounts of low cost/high failure rate items, and avoided stocking high cost/low failure rate items. Additionally, they both minimized backorders and maximized aircraft availability, across a given range of spares, to nearly equal levels.

The second conclusion is Dyna-METRIC had the advantage over MOD-METRIC for two reasons. First, Dyna-METRIC tended to stock more high failure rate items and less low failure rate items than MOD-METRIC. This characteristic of Dyna-METRIC (stocking more high failure rate items) for example, would reduce the dependency on supply and maintenance for rapid turn around of reparable spares. Likewise, having less low failure rate items allows the redirection of dollars to high demand type items. Second, Dyna-METRIC purchased less total items for the same cost as MOD-METRIC, but achieved the same results. At first glance it would appear spending more for equal capability is not a benefit. However, having less spares would reduce holding, handling and transportation costs and thereby, could achieve a significant savings in the long run.

This research has demonstrated the utility of Dyna-METRIC as a computational tool for use in initial provisioning. Further, it has demonstrated Dyna-METRIC's ability to compute an optimum level of initial provisioning support. Finally, the results of this research have clarified Dyna-METRIC's purpose and use in the dynamic initial provisioning environment. The results support the validity of Dyna-METRIC and the stated model assumptions on which the model is based.

Recommendations

Dyna-METRIC should be used often during the acquisition of a new weapon system as an evaluation and analysis tool. This is because "the model depicts the impact of logistics resources on operational scenarios and then describes those impacts in terms that the Air Force manager can use to resolve potential support shortfalls" (19:24). As soon as component level data becomes available, even if those data are only estimated, the Dyna-METRIC model becomes a powerful tool for: 1) establishing the investment dollar requirements, 2) computing the best mix of spare parts for any specified level of investment and, 3) assessing the expected level of performance given a stockage posture. It is this author's opinion that Dyna-METRIC is a valid decision

making tool for use in initial provisioning, and should be recognized as such by the United States Air Force.

A number of improvements can be suggested to any model that is used to simulate real world events. The decision to change the model should be based on the feasibility and realistic benefits expected from the effort. One major change to improve Dyna-METRIC that this author feels is worth exploring, was expressed also by Captain Mike Mills. He states:

> The depot stockage option and the base stockage option do not work well together. One uses a no cannibalization policy, while the other uses a full cannibalization policy. The depot stockage option also includes a confidence level not used in the base stockage option. A no cannibalization option for the depot should be included so consistent results could be achieved when this type of policy is desired. At present, the model computes each option separately, the base stockage option after the depot stockage option. This results in the bases stocking more parts if a shortage is perceived at the depot. This may not be the optimal mix between depot and base. The two options should be revised to work together, in order to optimally distribute stock between the depot and bases. (25:54)

A final recommendation concerns AFLCR 57-27 and includes two areas for further research. The first area for further research is to expand this study to include multi-indentured items. This research only addressed LRUs. Future research should include systems that contain LRUs, SRUs, and possibly subSRUs to expand and clarify the interdependent relationships. A study of this type would

reevaluate the results obtained from this research and could include sensitivity testing that would identify critical inputs and the range over which those inputs are applicable.

Secondly, the use of MCAIR's confidence level formula should undergo further research for it's application and validity for use with AFLCR 57-27 in initial provisioning. The purpose of this research was not to evaluate the formula but only to use it as a means for adjusting stock levels to meet the designated investment constraint.

Appendix A: Acronym Definitions

AFLC -- Air Force Logistics Command

AFLCR -- Air Force Logistics Command Regulation

AFM -- Air Force Manual

AFR -- Air Force Regulation

AFSC -- Air Force Systems Command

ALC -- Air Logistics Center

AMP -- Average Month Program

BCR -- Base Condemnation Rate

BRT -- Base Repair Time

CIRF -- Centralized Intermediate Repair Facility

COND -- Condemnation percent

DCR -- Depot Condemnation Rate

DPFH -- Demand Per Flying Hour

DRT -- Depot Repair Time

FMC -- Fully Mission Capable

FY -- Fiscal Year

HQ -- Headquarters

LRU -- Line Replaceable Unit

LSC -- Logistics Support Cadre

MCAIR -- McDonnell Aircraft Company

METRIC -- Multi Echelon Technique for Recoverable Inventory Control

MRF -- Maintenance Repair Factor

MTBD -- Mean Time Between Demand

NFMC -- Not Fully Mission Capable

NIMSR -- Non-consumable Item Material Support Request

NMCS -- Not Mission Capable Supply

NRTS -- Not Reparable This Station

OST -- Order and Ship Time

PCSL -- Procurement Cycle Safety Level

PIO -- Provisioning Item Order

PLT -- Production Lead Time

PMP -- Peak Month Program

PTD -- Provisioning Technical Documentation

QPA -- Quantity Per Aircraft

QPEI -- Quantity Per End Item

SAIP -- Spares Acquisition Integrated with Production

SD -- Standard Deviation

SPTD -- Supplemental Provisioning Technical Documentation

SRU -- Shop Replaceable Unit

SSR -- Supply Support Request

USAF -- United States Air Force

WUC -- Work Unit Code

Appendix B: MOD-METRIC Input File

```
92 MOD-METRIC INPUTS FOR F15 INITIAL SPARES STUDY
91 NO IPT IPH IBSO
98  6 010 0
91 NBIS BETA BSTART BSTOP CFAC PBINC CANNOP DELAYOP
99  10  3.00  3.01  0.00  1.00  .001
91  NB HRS1 OS1 HRS2 OS2
97   2 1008.14. 3735.14.
91  NB  AC1   AC2
93   2  24.   83.
91 WUC                           COST  MTBD NRTS C Q BR DR PLT
11 46AAA                          350 11000 100  1 2 10 56 14       00
15 46AAA                           0
11 46AAK                          420 25000 100  1 1 10 41 14       00
15 46AAK                           0
11 46AAL                          240 35000 100  1 1 10 41 13       00
15 46AAL                           0
11 46AAM                          350 11000 100  1 1 10 56 14       00
15 46AAM                           0
11 46AAV                          554 11000 100  1 1 10 41 14       00
15 46AAV                           0
11 46AAW                         2900 60000 100  1 2 10 41 17       00
15 46AAW                           0
11 46AAX                          547 25000 100  1 1 10 41 14       00
15 46AAX                           0
11 46AAY                          240 35000 100  1 1 10 41 13       00
15 46AAY                           0
11 46ABD                          547 25000 100  1 2 10 41 14       00
15 46ABD                           0
11 46ABE                          240 35000 100  1 2 10 41 13       00
15 46ABE                           0
11 46ABF                          547 25000 100  1 1 10 41 14       00
15 46ABF                           0
11 46ABG                          240 35000 100  1 1 10 41 13       00
15 46ABG                           0
11 46ACA                         1956  1250 100  1 1 10 41 14       00
15 46ACA                           0
11 46ACB                          467 14000 100  1 1 10 41 15       00
15 46ACB                           0
11 46ACG                         1005  8333  70  1 1 10 41 16       00
15 46ACG                           0
11 46ACP                          911 13000 100  1 1 10 41 16       00
15 46ACP                           0
11 46ADD                          720  7000 100  1 1 10 41 14       00
15 46ADD                           0
11 46ADE                         5412 13000  20  1 1 10 41 13       00
15 46ADE                           0
```

11	46ADC	1300	38824	80	2	2	10	41	13		00
15	46ADC	0									
11	46ADK	350	1000	100	1	1	10	56	15		00
15	46ADK	0									
11	46ADN	1732	3300	100	2	1	10	41	14		00
15	46ADN	0									
11	46ADP	554	11000	100	1	1	10	41	14		00
15	46ADP	0									
11	46ADR	685	11000	100	1	1	10	41	15		00
15	46ADR	0									
11	46ADS	685	11000	100	1	1	10	41	15		00
15	46ADS	0									
11	46AEA	5486	2200	70	1	1	10	41	19		00
15	46AEA	0									
11	46AEC	4059	3700	30	1	1	10	41	19		00
15	46AEC	0									
11	46AEE	1467	3846	70	1	1	10	41	18		00
15	46AEE	0									
11	46AEF	1282	3700	30	1	1	10	41	19		00
15	46AEF	0									
11	46BAA	10300	2000	0	1	3	10	41	18		00
15	46BAA	0									
11	46BBA	260	50000	60	1	1	10	41	13		00
15	46BBA	0									
11	46BBB	183	20000	60	1	3	10	41	14		00
15	46BBB	0									
11	46BBC	359	25000	100	1	1	6	41	15		00
15	46BBC	0									
11	46BBE	651	35000	100	1	1	6	41	12		00
15	46BBE	0									
11	46BCA	826	10000	100	1	2	10	41	15		00
15	46BCA	0									
11	46BCB	1800	8333	100	1	3	10	41	15		00
15	46BCB	0									
11	46BCC	170	40000	90	1	1	10	41	13		00
15	46BCC	0									
11	46BCF	261	18000	90	1	1	10	41	23		00
15	46BCF	0									
11	46BCH	360	10000	80	1	1	10	41	15		00
15	46BCH	0									
11	46BCL	501	6624	100	10	4	10	41	12		00
15	46BCL	0									
11	46DAC	1318	7059	80	1	1	10	41	17		00
15	46DAC	0									
11	46DAD	3130	6200	60	1	1	10	41	15		00
15	46DAD	0									

Appendix C: AFLCR 57-27 Spreadsheet

AFLCR 57-27 SPREADSHEET LEGEND

NAME		VALUE OR EQUATION	SOURCE
AMP	=	4.32 for FY 73, 31.34 for FY 74	Mr. Willis
PMP	=	8.10 for FY 73, 47.43 for FY 74	Mr. Willis
SD	=	0.00 for Basic AFLCR 57-27, 3.28 for Adjusted AFLCR 57-27	Input Value
PCSL	=	3.	Mr. Willis
OST	=	14.	AFLCR 57-4
WUC	=	FY 73 MOD-METRIC LRU Input Data	Mr. Lyle
COST	=	FY 73 MOD-METRIC LRU Input Data	Mr. Lyle
MTBD	=	FY 73 MOD-METRIC LRU Input Data	Mr. Lyle
MRF	=	1 / MTBD * 100.	Mr. Willis
NRTS	=	FY 73 MOD-METRIC LRU Input Data	Mr. Lyle
DCR	=	FY 73 MOD-METRIC LRU Input Data	Mr. Lyle
BCR	=	FY 73 MOD-METRIC LRU Input Data	Mr. Lyle

QPEI	=	FY 73 MOD-METRIC LRU Input Data	Mr. Lyle
PLT	=	FY 73 MOD-METRIC LRU Input Data	Mr. Lyle
DRC	=	FY 73 MOD-METRIC LRU Input Data	Mr. Lyle
BRC	=	FY 73 MOD-METRIC LRU Input Data	Mr. Lyle
PCSL QTY	=	MRF * ((NRTS * DCR) + ((1-NRTS) * BCR)) * QPEI * AMP * PCSL	Mr. Willis
PLT QTY	=	MRF * ((NRTS * DCR) + ((1-NRTS) * BCR)) * QPEI * AMP * PLT	Mr. Willis
DRC QTY	=	((MRF * NRTS) + (MRF * (1-NRTS) * BCR))) * QPEI * AMP * DCR / 30.	Mr. Willis
BRC QTY	=	MRF * (1-NRTS) * (1-BCR) * QPEI * PMP * BCR / 30.	Mr. Willis
OST QTY	=	((MRF * NRTS) + (MRF * (1-NRTS) * BCR)) * QPEI * PMP * OST / 30.	Mr. Willis
TOTAL QTY	=	PCSL QTY + PLT QTY + DRC QTY + BRC QTY + OST QTY	Mr. Willis
FACTOR QTY	=	SD * SQUARE ROOT of (TOTAL QTY)	Mr. Willis
RNDED QTY	=	INTEGER of (TOTAL QTY + FACTOR QTY + .5)	Mr. Willis
COST	=	COST * RNDED QTY	

BASIC AFLCR 57-27 SPREADSHEET CALCULATIONS FY 73 (SD = 0.00)

AMP	PMP	SD	PCSL	OST
4.32	8.1	0.00	3	14

WUC	COST	MTBD	MRF	NRTS	DCR	BCR	QPEI	PLT	DRC	BRC	PCSL QTY	PLT QTY	DRC QTY	BRC QTY	OST QTY	TOTAL QTY	FACTOR QTY	RNDED TOTAL	COST
46AAA	350	11000	.00909	1.00	.01	0.00	2	14	56	10	.0024	.0110	.1466	0.0000	.0687	.2287	0.000	0	0
46AAK	420	25000	.00400	1.00	.01	0.00	1	14	41	10	.0005	.0024	.0236	0.0000	.0151	.0417	0.000	0	0
46AAL	240	35000	.00286	1.00	.01	0.00	1	13	41	10	.0004	.0016	.0169	0.0000	.0108	.0296	0.000	0	0
46AAM	350	11000	.00909	1.00	.01	0.00	1	14	56	10	.0012	.0055	.0733	0.0000	.0344	.1143	0.000	0	0
46AAV	554	11000	.00909	1.00	.01	0.00	1	14	41	10	.0012	.0055	.0537	0.0000	.0344	.0947	0.000	0	0
46AAW	2900	60000	.00167	1.00	.01	0.00		17	41	10	.0004	.0024	.0197	0.0000	.0126	.0352	0.000	0	0
46AAX	547	25000	.00400	1.00	.01	0.00	1	14	41	10	.0005	.0024	.0236	0.0000	.0151	.0417	0.000	0	0
46AAY	240	35000	.00286	1.00	.01	0.00	1	13	41	10	.0004	.0016	.0169	0.0000	.0108	.0296	0.000	0	0
46ABD	547	25000	.00400	1.00	.01	0.00	2	14	41	10	.0010	.0048	.0472	0.0000	.0302	.0833	0.000	0	0
46ABE	240	35000	.00286	1.00	.01	0.00	2	13	41	10	.0007	.0032	.0337	0.0000	.0216	.0593	0.000	0	0
46ABF	547	25000	.00400	1.00	.01	0.00	1	14	41	10	.0005	.0024	.0236	0.0000	.0151	.0417	0.000	0	0
46ABG	240	35000	.00286	1.00	.01	0.00	1	13	41	10	.0004	.0016	.0169	0.0000	.0108	.0296	0.000	0	0
46ACA	1956	1250	.08000	1.00	.01	0.00	1	14	41	10	.0104	.0484	.4723	0.0000	.3024	.8335	0.000	1	1956
46ACB	467	14000	.00714	1.00	.01	0.00	1	15	41	10	.0009	.0046	.0422	0.0000	.0270	.0747	0.000	0	0
46ACG	1005	8333	.01200	.70	.01	0.00	1	16	41	10	.0011	.0058	.0496	.0097	.0318	.0980	0.000	0	0
46ACP	911	13000	.00769	1.00	.01	0.00	1	16	41	10	.0010	.0053	.0454	0.0000	.0291	.0808	0.000	0	0
46ADD	720	7000	.01429	1.00	.01	0.00	1	14	41	10	.0019	.0086	.0843	0.0000	.0540	.1488	0.000	0	0
46ADE	5412	13000	.00769	.20	.01	0.00	1	13	41	10	.0002	.0009	.0091	.0166	.0058	.0326	0.000	0	0
46ADG	1300	38824	.00258	.80	.02	0.00	2	13	41	10	.0011	.0046	.0243	.0028	.0156	.0484	0.000	0	0
46ADK	350	1000	.10000	1.00	.01	0.00	1	15	56	10	.0130	.0648	.8064	0.0000	.3780	1.2622	0.000	1	350
46ADN	1732	3300	.03030	1.00	.02	0.00	1	14	41	10	.0079	.0367	.1789	0.0000	.1145	.3380	0.000	0	0
46ADP	554	11000	.00909	1.00	.01	0.00	1	14	41	10	.0012	.0055	.0537	0.0000	.0344	.0947	0.000	0	0
46ADR	685	11000	.00909	1.00	.01	0.00	1	15	41	10	.0012	.0059	.0537	0.0000	.0344	.0951	0.000	0	0
46ADS	685	11000	.00909	1.00	.01	0.00	1	15	41	10	.0012	.0059	.0537	0.0000	.0344	.0951	0.000	0	0
46AEA	5486	2200	.04545	.70	0.00	.01	1	19	41	10	.0018	.0112	.1887	.0365	.1208	.3589	0.000	0	0
46AEC	4059	3700	.02703	.30	0.00	.01	1	19	41	10	.0025	.0155	.0490	.0506	.0314	.1489	0.000	0	0
46AEE	1467	3846	.02600	.70	0.00	.01	1	18	41	10	.0010	.0061	.1079	.0209	.0691	.2049	0.000	0	0
46AEF	1282	3700	.02703	.30	0.00	.01	1	19	41	10	.0025	.0155	.0490	.0506	.0314	.1489	0.000	0	0

46BAA	10300	2000	.05000	0.00	.01	0.00	3	18	41	10	0.0000	0.0000	0.0000	.4050	0.0000	.4050	0.000	0	0
46BBA	260	50000	.00200	.60	.01	0.00	1	13	41	10	.0002	.0007	.0071	.0022	.0045	.0146	0.000	0	0
46BBB	183	20000	.00500	.60	.01	0.00	3	14	41	10	:0012	.0054	.0531	.0162	.0340	.1100	0.000	0	0
46BBC	359	25000	.00400	1.00	.01	0.00	1	15	41	6	.0005	.0026	.0236	0.0000	.0151	.0418	0.000	0	0
46BBE	651	35000	.00286	1.00	.01	0.00	1	12	41	6	.0004	.0015	.0169	0.0000	.0108	.0295	0.000	0	0
46BCA	826	10000	.01000	1.00	.01	0.00	2	15	41	10	.0026	.0130	.1181	0.0000	.0756	.2092	0.000	0	0
46BCB	1800	8333	.01200	1.00	.01	0.00	3	15	41	10	.0047	.0233	.2126	0.0000	.1361	.3766	0.000	0	0
46BCC	170	40000	.00250	.90	.01	0.00	1	13	41	10	.0003	.0013	.0133	.0007	.0085	.0240	0.000	0	0
46BCF	261	18000	.00556	.90	.01	0.00	1	23	41	10	.0006	.0050	.0295	.0015	.0189	.0555	0.000	0	0
46BCH	360	10000	.01000	.80	.01	0.00	1	15	41	10	.0010	.0052	.0472	.0054	.0302	.0891	0.000	0	0
46BCL	501	6624	.01510	1.00	.10	0.00	4	12	41	10	.0783	.3130	.3565	0.0000	.2283	.9761	0.000	1	501
46DAC	1318	7059	.01417	.80	.01	0.00	1	17	41	10	.0015	.0083	.0669	.0076	.0428	.1272	0.000	0	0
46DAD	3130	6200	.01613	.60	.01	0.00	1	15	41	10	.0013	.0063	.0571	.0174	.0366	.1187	0.000	0	0

FY 73 TOTAL COST 2807

BASIC AFLCR 57-27 SPREADSHEET CALCULATIONS FY 74 (SD = 0.00)

AMP PMP
31.34 47.43

WUC	COST	MTBD	MRF	NRTS	DCR	BCR	QPEI	PLT	DRC	BRC	PCSL QTY	PLT QTY	DRC QTY	BRC QTY	OST QTY	TOTAL QTY	FACTOR QTY	RNDED TOTAL	COST
46AAA	350	11000	.00909	1.00	.01	0.00	2	14	56	10	.0171	.0798	1.0637	0.0000	.4024	1.5630	0.000	2	700
46AAK	420	25000	.00400	1.00	.01	0.00	1	14	41	10	.0038	.0176	.1713	0.0000	.0885	.2812	0.000	0	0
46AAL	240	35000	.00286	1.00	.01	0.00	1	13	41	10	.0027	.0116	.1224	0.0000	.0632	.1999	0.000	0	0
46AAM	350	11000	.00909	1.00	.01	0.00	1	14	56	10	.0085	.0399	.5318	0.0000	.2012	.7815	0.000	1	350
46AAV	554	11000	.00909	1.00	.01	0.00	1	14	41	10	.0085	.0399	.3894	0.0000	.2012	.6390	0.000	1	554
46AAW	2900	60000	.00167	1.00	.01	0.00	2	17	41	10	.0031	.0178	.1428	0.0000	.0738	.2374	0.000	0	0
46AAX	547	25000	.00400	1.00	.01	0.00	1	14	41	10	.0038	.0176	.1713	0.0000	.0885	.2812	0.000	0	0
46AAY	240	35000	.00286	1.00	.01	0.00	1	13	41	10	.0027	.0116	.1224	0.0000	.0632	.1999	0.000	0	0
46ABD	547	25000	.00400	1.00	.01	0.00	2	14	41	10	.0075	.0351	.3427	0.0000	.1771	.5623	0.000	1	547
46ABE	240	35000	.00286	1.00	.01	0.00	2	13	41	10	.0054	.0233	.2448	0.0000	.1265	.3999	0.000	0	0
46ABF	547	25000	.00400	1.00	.01	0.00	1	14	41	10	.0038	.0176	.1713	0.0000	.0885	.2812	0.000	0	0

46ABG	240	35000	.00286	1.00	.01	0.00	1	13	41	10	.0027	.0116	.1224	0.0000	.0632	.1999	0.000	0	0
46ACA	1956	1250	.08000	1.00	.01	0.00	1	14	41	10	.0752	.3510	3.4265	0.0000	1.7707	5.6235	0.000	6	11736
46ACB	467	14000	.00714	1.00	.01	0.00	1	15	41	10	.0067	.0336	.3059	0.0000	.1581	.5043	0.000	1	467
46ACG	1005	8333	.01200	.70	.01	0.00	1	16	41	10	.0079	.0421	.3598	.0569	.1859	.6527	0.000	1	1005
46ACP	911	13000	.00769	1.00	.01	0.00	1	16	41	10	.0072	.0386	.3295	0.0000	.1703	.5455	0.000	1	911
46ADD	720	7000	.01429	1.00	.01	0.00	1	14	41	10	.0134	.0627	.6119	0.0000	.3162	1.0042	0.000	1	720
46ADE	5412	13000	.00769	.20	.01	0.00	1	13	41	10	.0014	.0063	.0659	.0973	.0341	.2050	0.000	0	0
46ADG	1300	38824	.00258	.80	.02	0.00	2	13	41	10	.0077	.0336	.1765	.0163	.0912	.3254	0.000	0	0
46ADK	350	1000	.10000	1.00	.01	0.00	1	15	56	10	.0940	.4701	5.8501	0.0000	2.2134	8.6277	0.000	9	3150
46ADN	1732	3300	.03030	1.00	.02	0.00	1	14	41	10	.0570	.2659	1.2979	0.0000	.6707	2.2915	0.000	2	3464
46ADP	554	11000	.00909	1.00	.01	0.00	1	14	41	10	.0085	.0399	.3894	0.0000	.2012	.6390	0.000	1	554
46ADR	685	11000	.00909	1.00	.01	0.00	1	15	41	10	.0085	.0427	.3894	0.0000	.2012	.6419	0.000	1	685
46ADS	685	11000	.00909	1.00	.01	0.00	1	15	41	10	.0085	.0427	.3894	0.0000	.2012	.6419	0.000	1	685
46AEA	5486	2200	.04545	.70	0.00	.01	1	19	41	10	.0128	.0812	1.3687	.2134	.7073	2.3834	0.000	2	10972
46AEC	4059	3700	.02703	.30	0.00	.01	1	19	41	10	.0178	.1127	.3554	.2961	.1837	.9656	0.000	1	4059
46AEE	1467	3846	.02600	.70	0.00	.01	1	18	41	10	.0073	.0440	.7829	.1221	.4046	1.3609	0.000	1	1467
46AEF	1282	3700	.02703	.30	0.00	.01	1	19	41	10	.0178	.1127	.3554	.2961	.1837	.9656	0.000	1	1282
46BAA	10300	2000	.05000	0.00	.01	0.00	3	18	41	10	0.0000	0.0000	0.0000	2.3715	0.0000	2.3715	0.000	2	20600
46BBA	260	50000	.00200	.60	.01	0.00	1	13	41	10	.0011	.0049	.0514	.0126	.0266	.0966	0.000	0	0
46BBB	183	20000	.00500	.60	.01	0.00	3	14	41	10	.0085	.0395	.3855	.0949	.1992	.7275	0.000	1	183
46BBC	359	25000	.00400	1.00	.01	0.00	1	15	41	6	.0038	.0188	.1713	0.0000	.0885	.2824	0.000	0	0
46BBE	651	35000	.00286	1.00	.01	0.00	1	12	41	6	.0027	.0107	.1224	0.0000	.0632	.1990	0.000	0	0
46BCA	826	10000	.01000	1.00	.01	0.00	2	15	41	10	.0188	.0940	.8566	0.0000	.4427	1.4121	0.000	1	826
46BCB	1800	8333	.01200	1.00	.01	0.00	3	15	41	10	.0338	.1692	1.5420	0.0000	.7969	2.5419	0.000	3	5400
46BCC	170	40000	.00250	.90	.01	0.00	1	13	41	10	.0021	.0092	.0964	.0040	.0498	.1614	0.000	0	0
46BCF	261	18000	.00556	.90	.01	0.00	1	23	41	10	.0047	.0360	.2142	.0088	.1107	.3744	0.000	0	0
46BCH	360	10000	.01000	.80	.01	0.00	1	15	41	10	.0075	.0376	.3427	.0316	.1771	.5965	0.000	1	360
46BCL	501	6624	.01510	1.00	.10	0.00	4	12	41	10	.5678	2.2710	2.5864	0.0000	1.3366	6.7618	0.000	7	3507
46DAC	1318	7059	.01417	.80	.01	0.00	1	17	41	10	.0107	.0604	.4854	.0448	.2508	.8521	0.000	1	1318
46DAD	3130	6200	.01613	.60	.01	0.00	1	15	41	10	.0091	.0455	.4145	.1020	.2142	.7853	0.000	1	3130

FY 74 TOTAL COST 78632

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FY 73 AND FY 74 GRAND TOTAL 81439

ADJUSTED AFLCR 57-27 SPREADSHEET CALCULATIONS FY 73 (SD = 3.28)

AMP	PMP	SD	PCSL	OST
4.32	8.1	3.28	3	14

WUC	COST	MTBD	MRF	NRTS	DCR	BCR	QPEI	PLT	DRC	BRC	PCSL QTY	PLT QTY	DRC QTY	BRC QTY	OST QTY	TOTAL QTY	FACTOR QTY	RNDED TOTAL	COST
46AAA	350	11000	.00909	1.00	.01	0.00	2	14	56	10	.0024	.0110	.1466	0.0000	.0687	.2287	1.569	2	700
46AAK	420	25000	.00400	1.00	.01	0.00	1	14	41	10	.0005	.0024	.0236	0.0000	.0151	.0417	.670	1	420
46AAL	240	35000	.00286	1.00	.01	0.00	1	13	41	10	.0004	.0016	.0169	0.0000	.0108	.0296	.565	1	240
46AAM	350	11000	.00909	1.00	.01	0.00	1	14	56	10	.0012	.0055	.0733	0.0000	.0344	.1143	1.109	1	350
46AAV	554	11000	.00909	1.00	.01	0.00	1	14	41	10	.0012	.0055	.0537	0.0000	.0344	.0947	1.009	1	554
46AAW	2900	60000	.00167	1.00	.01	0.00	2	17	41	10	.0004	.0024	.0197	0.0000	.0126	.0352	.615	1	2900
46AAX	547	25000	.00400	1.00	.01	0.00	1	14	41	10	.0005	.0024	.0236	0.0000	.0151	.0417	.670	1	547
46AAY	240	35000	.00286	1.00	.01	0.00	1	13	41	10	.0004	.0016	.0169	0.0000	.0108	.0296	.565	1	240
46ABD	547	25000	.00400	1.00	.01	0.00	2	14	41	10	.0010	.0048	.0472	0.0000	.0302	.0833	.947	1	547
46ABE	240	35000	.00286	1.00	.01	0.00	2	13	41	10	.0007	.0032	.0337	0.0000	.0216	.0593	.799	1	240
46ABF	547	25000	.00400	1.00	.01	0.00	1	14	41	10	.0005	.0024	.0236	0.0000	.0151	.0417	.670	1	547
46ABG	240	35000	.00286	1.00	.01	0.00	1	13	41	10	.0004	.0016	.0169	0.0000	.0108	.0296	.565	1	240
46ACA	1956	1250	.08000	1.00	.01	0.00	1	14	41	10	.0104	.0484	.4723	0.0000	.3024	.8335	2.994	4	7824
46ACB	467	14000	.00714	1.00	.01	0.00	1	15	41	10	.0009	.0046	.0422	0.0000	.0270	.0747	.897	1	467
46ACG	1005	8333	.01200	.70	.01	0.00	1	16	41	10	.0011	.0058	.0496	.0097	.0318	.0980	1.027	1	1005
46ACP	911	13000	.00769	1.00	.01	0.00	1	16	41	10	.0010	.0053	.0454	0.0000	.0291	.0808	.932	1	911
46ADD	720	7000	.01429	1.00	.01	0.00	1	14	41	10	.0019	.0086	.0843	0.0000	.0540	.1488	1.265	1	720
46ADE	5412	13000	.00769	.20	.01	0.00	1	13	41	10	.0002	.0009	.0091	.0166	.0058	.0326	.592	1	5412
46ADG	1300	38824	.00258	.80	.02	0.00	2	13	41	10	.0011	.0046	.0243	.0028	.0156	.0484	.722	1	1300
46ADK	350	1000	.10000	1.00	.01	0.00	1	15	56	10	.0130	.0648	.8064	0.0000	.3780	1.2622	3.685	5	1750
46ADN	1732	3300	.03030	1.00	.02	0.00	1	14	41	10	.0079	.0367	.1789	0.0000	.1145	.3380	1.907	2	3464
46ADP	554	11000	.00909	1.00	.01	0.00	1	14	41	10	.0012	.0055	.0537	0.0000	.0344	.0947	1.009	1	554
46ADR	685	11000	.00909	1.00	.01	0.00	1	15	41	10	.0012	.0059	.0537	0.0000	.0344	.0951	1.012	1	685
46ADS	685	11000	.00909	1.00	.01	0.00	1	15	41	10	.0012	.0059	.0537	0.0000	.0344	.0951	1.012	1	685
46AEA	5486	2200	.04545	.70	0.00	.01	1	19	41	10	.0018	.0112	.1887	.0365	.1208	.3589	1.965	2	10972
46AEC	4059	3700	.02703	.30	0.00	.01	1	19	41	10	.0025	.0155	.0490	.0506	.0314	.1489	1.266	1	4059
46AEE	1467	3846	.02600	.70	0.00	.01	1	18	41	10	.0010	.0061	.1079	.0209	.0691	.2049	1.485	2	2934
46AEF	1282	3700	.02703	.30	0.00	.01	1	19	41	10	.0025	.0155	.0490	.0506	.0314	.1489	1.266	1	1282

46BAA	10300	2000	.05000	0.00	.01	0.00	3	18	41	10	0.0000	0.0000	0.0000	.4050	0.0000	.4050	2.087	2	20600
46BBA	260	50000	.00200	.60	.01	0.00	1	13	41	10	.0002	.0007	.0071	.0022	.0045	.0146	.396	0	0
46BBB	183	20000	.00500	.60	.01	0.00	3	14	41	10	.0012	.0054	.0531	.0162	.0340	.1100	1.088	1	183
46BBC	359	25000	.00400	1.00	.01	0.00	1	15	41	6	.0005	.0026	.0236	0.0000	.0151	.0418	.671	1	359
46BBE	651	35000	.00286	1.00	.01	0.00	1	12	41	6	.0004	.0015	.0169	0.0000	.0108	.0295	.564	1	651
46BCA	826	10000	.01000	1.00	.01	0.00	2	15	41	10	.0026	.0130	.1181	0.0000	.0756	.2092	1.500	2	1652
46BCB	1800	8333	.01200	1.00	.01	0.00	3	15	41	10	.0047	.0233	.2126	0.0000	.1361	.3766	2.013	2	3600
46BCC	170	40000	.00250	.90	.01	0.00	1	13	41	10	.0003	.0013	.0133	.0007	.0085	.0240	.508	1	170
46BCF	261	18000	.00556	.90	.01	0.00	1	23	41	10	.0006	.0050	.0295	.0015	.0189	.0555	.773	1	261
46BCH	360	10000	.01000	.80	.01	0.00	1	15	41	10	.0010	.0052	.0472	.0054	.0302	.0891	.979	1	360
46BCL	501	6624	.01510	1.00	.10	0.00	4	12	41	10	.0783	.3130	.3565	0.0000	.2283	.9761	3.241	4	2004
46DAC	1318	7059	.01417	.80	.01	0.00	1	17	41	10	.0015	.0083	.0669	.0076	.0428	.1272	1.170	1	1318
46DAD	3130	6200	.01613	.60	.01	0.00	1	15	41	10	.0013	.0063	.0571	.0174	.0366	.1187	1.130	1	3130

FY 73 TOTAL COST 85837

ADJUSTED AFLCR 57-27 SPREADSHEET CALCULATIONS FY 74 (SD = 3.28)

AMP PMP
31.34 47.43

WUC	COST	MTBD	MRF	NRTS	DCR	BCR	QPEI	PLT	DRC	BRC	PCSL QTY	PLT QTY	DRC QTY	BRC QTY	OST QTY	TOTAL QTY	FACTOR QTY	RNDED TOTAL	COST
46AAA	350	11000	.00909	1.00	.01	0.00	2	14	56	10	.0171	.0798	1.0637	0.0000	.4024	1.5630	4.101	6	2100
46AAK	420	25000	.00400	1.00	.01	0.00	1	14	41	10	.0038	.0176	.1713	0.0000	.0885	.2812	1.739	2	840
46AAL	240	35000	.00286	1.00	.01	0.00	1	13	41	10	.0027	.0116	.1224	0.0000	.0632	.1999	1.467	2	480
46AAM	350	11000	.00909	1.00	.01	0.00	1	14	56	10	.0085	.0399	.5318	0.0000	.2012	.7815	2.900	4	1400
46AAV	554	11000	.00909	1.00	.01	0.00	1	14	41	10	.0085	.0399	.3894	0.0000	.2012	.6390	2.622	3	1662
46AAW	2900	60000	.00167	1.00	.01	0.00	2	17	41	10	.0031	.0178	.1428	0.0000	.0738	.2374	1.598	2	5800
46AAX	547	25000	.00400	1.00	.01	0.00	1	14	41	10	.0038	.0176	.1713	0.0000	.0885	.2812	1.739	2	1094
46AAY	240	35000	.00286	1.00	.01	0.00	1	13	41	10	.0027	.0116	.1224	0.0000	.0632	.1999	1.467	2	480
46ABD	547	25000	.00400	1.00	.01	0.00	2	14	41	10	.0075	.0351	.3427	0.0000	.1771	.5623	2.460	3	1641
46ABE	240	35000	.00286	1.00	.01	0.00	2	13	41	10	.0054	.0233	.2448	0.0000	.1265	.3999	2.074	2	480
46ABF	547	25000	.00400	1.00	.01	0.00	1	14	41	10	.0038	.0176	.1713	0.0000	.0885	.2812	1.739	2	1094

46ABG	240	35000	.00286	1.00	.01	0.00	1	13	41	10	.0027	.0116	.1224	0.0000	.0632	.1999	1.467	2	480
46ACA	1956	1250	.08000	1.00	.01	0.00	1	14	41	10	.0752	.3510	3.4265	0.0000	1.7707	5.6235	7.778	13	25428
46ACB	467	14000	.00714	1.00	.01	0.00	1	15	41	10	.0067	.0336	.3059	0.0000	.1581	.5043	2.329	3	1401
46ACG	1005	8333	.01200	.70	.01	0.00	1	16	41	10	.0079	.0421	.3598	.0569	.1859	.6527	2.650	3	3015
46ACP	911	13000	.00769	1.00	.01	0.00	1	16	41	10	.0072	.0386	.3295	0.0000	.1703	.5455	2.423	3	2733
46ADD	720	7000	.01429	1.00	.01	0.00	1	14	41	10	.0134	.0627	.6119	0.0000	.3162	1.0042	3.287	4	2880
46ADE	5412	13000	.00769	.20	.01	0.00	1	13	41	10	.0014	.0063	.0659	.0973	.0341	.2050	1.485	2	10824
46ADG	1300	38824	.00258	.80	.02	0.00	2	13	41	10	.0077	.0336	.1765	.0163	.0912	.3254	1.871	2	2600
46ADK	350	1000	.10000	1.00	.01	0.00	1	15	56	10	.0940	.4701	5.8501	0.0000	2.2134	8.6277	9.634	18	6300
46ADN	1732	3300	.03030	1.00	.02	0.00	1	14	41	10	.0570	.2659	1.2979	0.0000	.6707	2.2915	4.965	7	12124
46ADP	554	11000	.00909	1.00	.01	0.00	1	14	41	10	.0085	.0399	.3894	0.0000	.2012	.6390	2.622	3	1662
46ADR	685	11000	.00909	1.00	.01	0.00	1	15	41	10	.0085	.0427	.3894	0.0000	.2012	.6419	2.628	3	2055
46ADS	685	11000	.00909	1.00	.01	0.00	1	15	41	10	.0085	.0427	.3894	0.0000	.2012	.6419	2.628	3	2055
46AEA	5486	2200	.04545	.70	0.00	.01	1	19	41	10	.0128	.0812	1.3687	.2134	.7073	2.3834	5.064	7	38402
46AEC	4059	3700	.02703	.30	0.00	.01	1	19	41	10	.0178	.1127	.3554	.2961	.1837	.9656	3.223	4	16236
46AEE	1467	3846	.02600	.70	0.00	.01	1	18	41	10	.0073	.0440	.7829	.1221	.4046	1.3609	3.826	5	7335
46AEF	1282	3700	.02703	.30	0.00	.01	1	19	41	10	.0178	.1127	.3554	.2961	.1837	.9656	3.223	4	5128
46BAA	10300	2000	.05000	0.00	.01	0.00	3	18	41	10	0.0000	0.0000	0.0000	2.3715	0.0000	2.3715	5.051	7	72100
46BBA	260	50000	.00200	.60	.01	0.00	1	13	41	10	.0011	.0049	.0514	.0126	.0266	.0966	1.020	1	260
46BBB	183	20000	.00500	.60	.01	0.00	3	14	41	10	.0085	.0395	.3855	.0949	.1992	.7275	2.798	4	732
46BBC	359	25000	.00400	1.00	.01	0.00	1	15	41	6	.0038	.0188	.1713	0.0000	.0885	.2824	1.743	2	718
46BBE	651	35000	.00286	1.00	.01	0.00	1	12	41	6	.0027	.0107	.1224	0.0000	.0632	.1990	1.463	2	1302
46BCA	826	10000	.01000	1.00	.01	0.00	2	15	41	10	.0188	.0940	.8566	0.0000	.4427	1.4121	3.898	5	4130
46BCB	1800	8333	.01200	1.00	.01	0.00	3	15	41	10	.0338	.1692	1.5420	0.0000	.7969	2.5419	5.229	8	14400
46BCC	170	40000	.00250	.90	.01	0.00	1	13	41	10	.0021	.0092	.0964	.0040	.0498	.1614	1.318	1	170
46BCF	261	18000	.00556	.90	.01	0.00	1	23	41	10	.0047	.0360	.2142	.0088	.1107	.3744	2.007	2	522
46BCH	360	10000	.01000	.80	.01	0.00	1	15	41	10	.0075	.0376	.3427	.0316	.1771	.5965	2.533	3	1080
46BCL	501	6624	.01510	1.00	.10	0.00	4	12	41	10	.5678	2.2710	2.5864	0.0000	1.3366	6.7618	8.529	15	7515
46DAC	1318	7059	.01417	.80	.01	0.00	1	17	41	10	.0107	.0604	.4854	.0448	.2508	.8521	3.028	4	5272
46DAD	3130	6200	.01613	.60	.01	0.00	1	15	41	10	.0091	.0455	.4145	.1020	.2142	.7853	2.907	4	12520

FY 74 TOTAL COST 278450

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FY 73 AND FY 74 GRAND TOTAL 364287

Appendix D: Dyna-METRIC Input File

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DYNA-METRIC REQUIREMENTS MODE INPUTS FOR F15 INITIAL SPARES STUDY
 1                VERSION 4.4  MT1MT2MT3MT4MT5
  90 180 270 360 450 540 630 720
OPT
      2  1.9989
      9
     12  1.9999
     17     .99
BASE
BAS1                                                      1.0  1.0             1.0   1
BAS2                                                      1.0  1.0             1.0   1
DEPT
DEP1                                                      1.0  1.0             1.0
TRNS
BAS1 DEP1  14.0 14.0     1.0
BAS2 DEP1  14.0 14.0     1.0
ACFT
BAS1   0   1   2  31   5  61   7  91  10 121  12 151  15 181  17 211  20 241  22
 271  25 301  27 331  30 361  24
BAS2   0 361  12 391  18 421  25 451  31 481  38 511  44 541  50 571  57 601  63
 631  70 661  76 691  83
SRTS
BAS1 0.0   1 1.09999
BAS2 0.0 361 1.09999
FLHR
BAS1 0.0   1 0.9 361 1.49999
BAS2 0.0 361 1.59999
TURN
BAS1 0.0   1 3.09999
BAS2 0.0 361 3.09999
LRU
46AAA            DEP1 1 0  2  2 1 .00009 .00009 10.0 1.00
46AAA                           56.0    0.01 420. 420.    350.        1
46AAK            DEP1 1 0  1  1 1 .00004 .00004 10.0 1.00
46AAK                           41.0    0.01 420. 420.    420.        1
46AAL            DEP1 1 0  1  1 1 .00003 .00003 10.0 1.00
46AAL                           41.0    0.01 390. 390.    240.        1
46AAM            DEP1 1 0  1  1 1 .00009 .00009 10.0 1.00
46AAM                           56.0    0.01 420. 420.    350.        1
46AAV            DEP1 1 0  1  1 1 .00009 .00009 10.0 1.00
46AAV                           41.0    0.01 420. 420.    554.        1
46AAW            DEP1 1 0  2  2 1 .00002 .00002 10.0 1.00
46AAW                           41.0    0.01 510. 510.   2900.        1
46AAX            DEP1 1 0  1  1 1 .00004 .00004 10.0 1.00
46AAX                           41.0    0.01 420. 420.    547.        1
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46AAY	DEP1	1	0	1	1	1	.00003	.00003	10.0	1.00							
46AAY							41.0		0.01	390.	390.		240.		1		
46ABD	DEP1	1	0	2	2	1	.00004	.00004	10.0	1.00							
46ABD							41.0		0.01	420.	420.		547.		1		
46ABE	DEP1	1	0	2	2	1	.00003	.00003	10.0	1.00							
46ABE							41.0		0.01	390.	390.		240.		1		
46ABF	DEP1	1	0	1	1	1	.00004	.00004	10.0	1.00							
46ABF							41.0		0.01	420.	420.		547.		1		
46ABG	DEP1	1	0	1	1	1	.00003	.00003	10.0	1.00							
46ABG							41.0		0.01	390.	390.		240.		1		
46ACA	DEP1	1	0	1	1	1	.00080	.00080	10.0	1.00							
46ACA							41.0		0.01	420.	420.		1956.		1		
46ACB	DEP1	1	0	1	1	1	.00007	.00007	10.0	1.00							
46ACB							41.0		0.01	450.	450.		467.		1		
46ACG	DEP1	1	0	1	1	1	.00012	.00012	10.0	0.70							
46ACG							41.0		0.01	480.	480.		1005.		1		
46ACP	DEP1	1	0	1	1	1	.00008	.00008	10.0	1.00							
46ACP							41.0		0.01	480.	480.		911.		1		
46ADD	DEP1	1	0	1	1	1	.00014	.00014	10.0	1.00							
46ADD							41.0		0.01	420.	420.		720.		1		
46ADE	DEP1	1	0	1	1	1	.00008	.00008	10.0	0.20							
46ADE							41.0		0.01	390.	390.		5412.		1		
46ADG	DEP1	1	0	2	2	1	.00003	.00003	10.0	0.80							
46ADG							41.0		0.02	390.	390.		1300.		1		
46ADK	DEP1	1	0	1	1	1	.00100	.00100	10.0	1.00							
46ADK							56.0		0.01	450.	450.		350.		1		
46ADN	DEP1	1	0	1	1	1	.00030	.00030	10.0	1.00							
46ADN							41.0		0.02	420.	420.		1732.		1		
46ADP	DEP1	1	0	1	1	1	.00009	.00009	10.0	1.00							
46ADP							41.0		0.01	420.	420.		554.		1		
46ADR	DEP1	1	0	1	1	1	.00009	.00009	10.0	1.00							
46ADR							41.0		0.01	480.	480.		685.		1		
46ADS	DEP1	1	0	1	1	1	.00009	.00009	10.0	1.00							
46ADS							41.0		0.01	480.	480.		685.		1		
46AEA	DEP1	1	0	1	1	1	.00045	.00045	10.0	0.70	0.01						
46AEA							41.0		0.00	570.	570.		5486.		1		
46AEC	DEP1	1	0	1	1	1	.00027	.00027	10.0	0.30	0.01						
46AEC							41.0		0.00	570.	570.		4059.		1		
46AEE	DEP1	1	0	1	1	1	.00026	.00026	10.0	0.70	0.01						
46AEE							41.0		0.00	540.	540.		1467.		1		
46AEF	DEP1	1	0	1	1	1	.00027	.00027	10.0	0.30	0.01						
46AEF							41.0		0.00	570.	570.		1282.		1		
46BAA	DEP1	1	0	3	3	1	.00050	.00050	10.0	0.00							
46BAA							41.0		0.01	540.	540.		10300.		1		
46BBA	DEP1	1	0	1	1	1	.00002	.00002	10.0	0.60							
46BBA							41.0		0.01	390.	390.		260.		1		
46BBB	DEP1	1	0	3	3	1	.00005	.00005	10.0	0.60							
46BBB							41.0		0.01	420.	420.		183.		1		
46BBC	DEP1	1	0	1	1	1	.00004	.00004	6.0	1.00							
46BBC							41.0		0.01	450.	450.		359.		1		

46BBE	DEP1	1	0	1	1	1	.00003	.00003	6.0	1.00		
46BBE						41.0		0.01	360.	360.	651.	1
46BCA	DEP1	1	0	2	2	1	.00010	.00010	10.0	1.00		
46BCA						41.0		0.01	450.	450.	826.	1
46BCB	DEP1	1	0	3	3	1	.00012	.00012	10.0	1.00		
46BCB						41.0		0.01	450.	450.	1800.	1
46BCC	DEP1	1	0	1	1	1	.00003	.00003	10.0	0.90		
46BCC						41.0		0.01	390.	390.	170.	1
46BCF	DEP1	1	0	1	1	1	.00006	.00006	10.0	0.90		
46BCF						41.0		0.01	690.	690.	261.	1
46BCH	DEP1	1	0	1	1	1	.00010	.00010	10.0	0.80		
46BCH						41.0		0.01	450.	450.	360.	1
46BCL	DEP1	1	0	4	4	1	.00015	.00015	10.0	1.00		
46BCL						41.0		0.10	360.	360.	501.	1
46DAC	DEP1	1	0	1	1	1	.00014	.00014	10.0	0.80		
46DAC						41.0		0.01	510.	510.	1318.	1
46DAD	DEP1	1	0	1	1	1	.00016	.00016	10.0	0.60		
46DAD						41.0		0.01	450.	450.	3130.	1

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A goal of initial provisioning is to provide the highest level of readiness for a fixed level of investment. MOD-METRIC and AFLCR 57-27, the traditional initial provisioning methods, determine which spare parts are needed and in what quantity without considering aircraft readiness. On the other hand, Dyna-METRIC, an availability model, quantifies the number of spares needed and finds the optimal mix for a dynamic initial provisioning environment.

This research is a comparison of the requirements computation (stock level) recommended by each method and a comparison of the aircraft availability that resulted from those stock levels. The data consists of 41 fuel system Line Replaceable Units modeled during the initial provisioning of the F-15 aircraft in FY 73 and FY 74.

Results indicate that the Dyna-METRIC model performed equal to or better than the traditional methods for computing initial spare requirements given the same investment constraint. Further, the research suggests that the Dyna-METRIC model would recommend a smaller inventory of spare parts than the MOD-METRIC model while maintaining an equal level of performance.

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